Allen-Bradley

Guard I/O DeviceNet Safety Modules

Catalog Numbers 1732DS-IB8, 1732DS-IB8XOBV4, 1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4, 1791DS-IB8XOBV4, 1791DS-IB16

User Manual

Rockwell Automation

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://literature.rockwellautomation.com) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

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The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

WARNING	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence
SHOCK HAZARD	Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
BURN HAZARD	Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may be at dangerous temperatures.

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This publication contains new and revised information not in the last release.

Revised Information

See the table for a summary of the major revisions to this manual.

For Revised	See
Definition for electronic data sheet	Page 6
Attention statement	Page 8
Vertical mount graphic	Page 37
RSLogix 5000 software usage instructions	Chapter 4
PFH and PFD values	Page 113

New Information

See the table for a summary of the major additions to this manual.

For New	See
1791DS-IB16 figure	Page 18
RSNetworx for DeviceNet software usage instructions	Chapter 5
1791DS-IB16 PFH and PFD values	Page 114
1791DS-IB16 configuration data	Appendix D
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Change Bars

Change bars (as shown with this paragraph) show the areas in this manual that are different from previous editions and indicate the addition of new or revised information.

Notes:

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Notes

What This Preface Contains

This preface describes how to use this manual.

Who Should Use This Manual

This manual is intended for users of ArmorBlock Guard I/O and CompactBlock Guard I/O DeviceNet safety I/O modules.

Common Techniques Used in This Manual

The following conventions are used throughout this manual.

Numbered lists provide sequential steps.

Bulleted lists provide information, not procedural steps.

Additional Resources

Refer to the following as needed for additional help when setting up and using your modules.

Publication	Publication Number
ArmorBlock Guard I/O DeviceNet Module Installation Instructions	1732DS-IN001
CompactBlock Guard I/O DeviceNet Module Installation Instructions	1791DS-IN002
DeviceNet Modules in Logix5000 Control Systems User Manual	DNET-UM004
DeviceNet Safety I/O Modules Series 1791DS Installation Instructions - Catalog Numbers 1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4	1791DS-IN001
DeviceNet Safety Scanner for GuardPLC Controllers	1753-UM002
GuardLogix Controller Systems Safety Reference Manual	1756-RM093
GuardLogix Controllers User Manual	1756-UM020
GuardLogix Safety Application Instructions Safety Reference Manual	1756-RM095
GuardPLC Controller Systems User Manual	1753-UM001
GuardPLC Safety Reference Manual	1753-RM002
SmartGuard 600 Controllers Installation Instructions	1752-IN001
SmartGuard 600 Controllers Safety Reference Manual	1752-RM001
SmartGuard 600 Controllers User Manual	1752-UM001

How To Use This Manual

Read and understand this manual before using the described products. Consult your Rockwell Automation representative if you have any questions or comments. This manual describes how to use modules.

About the Specifications and Dimensions in This Manual

Product specifications and accessories can change at any time based on improvements and other reasons. Consult with your Rockwell Automation representative to confirm actual specifications of purchased product. Dimensions and weights are nominal and are not for use for manufacturing purposes, even when tolerances are shown.

Terminology

Refer to the table for the meaning of common terms.

This Term	Means
Bus off	Indicates a status of very high error-count occurrence on a communication cable. A bus off error is detected when the internal error counter counts more errors than the predetermined threshold value. (The error counter returns to zero when the master is started or restarted.)
Connection	Logical communication channel for communication between nodes. Connections are maintained and controlled between masters and slaves.
CRTL	Connection reaction time limit.
DeviceNet safety	An implementation of a safety protocol on a standard DeviceNet network.
EDS	Acronym for electronic data sheet, a template that RSNetWorx for DeviceNet software uses to display the configuration parameters, I/O data profile, and connection-type support for a given DeviceNet safety module. These are text files used by RSNetWorx for DeviceNet software to identify products and commission them on a network.
L-	Output return common.
M	Sinking output common channel, output switches to the common voltage.
MTBF	Acronym for mean time between failure, the average time between failure occurrences.
ODVA	Acronym for Open DeviceNet Vendor Association, a nonprofit association of vendors established for the promotion of DeviceNet networks.
P	Sourcing output channel, output switches to the plus voltage.
PFD	Acronym for probability of failure on demand, the average probability of a system to fail to perform its design function on demand.
PFH	Acronym for probability of failure per hour, the probability of a system to have a dangerous failure occur per hour.
Proof test	Periodic test performed to detect failures in a safety-related system so that, if necessary, the system can be restored to an as-new condition or as close as practical to this condition.
S+	Output return 24V.
SNN	Acronym for safety network number, which uniquely identifies a network across all networks in the safety system. You are responsible for assigning a unique number for each safety network or safety sub-net within a system.
Standard	Devices or portions of devices that do not participate in the safety function.

About the Modules

What This Chapter Contains

This chapter includes important overview information and precautions for use of the safety I/O modules that implement the DeviceNet safety protocol. Also included is an overview on how these I/O modules are used within a safety system.

Before You Begin

Always observe the following when using a module, noting that in this manual we use safety administrator to mean a person qualified, authorized, and responsible to secure safety in the design, installation, operation, maintenance, and disposal of the machine.

Make sure that a safety administrator who thoroughly understands the machine to be installed handles the module.

Thoroughly read and understand this manual before installing and operating the module.

Keep this manual in a safe place where the operator can refer to it when necessary.

Use the module properly according to the installation environment, performance, and functions of the machine.

Verify that a safety administrator conducts a risk assessment on the machine and determines module suitability before installation.

Verify that the external power supply that provides power to the I/O modules is safety extra-low voltage (SELV) rated.

Verify that the DeviceNet block safety I/O firmware version is correct prior to commissioning the safety system, noting that firmware information related to safety controllers is available at http://www.rockwellautomation.com/products/certification/safety/index.html.

Understand Suitability for Use

Rockwell Automation is not responsible for conformity with any standards, codes, or regulations that apply to the combination of the products in your application or use of the product.

Take all necessary steps to determine the suitability of the product for the systems, machine, and equipment with which it is used.

Know and observe all prohibitions of use applicable to this product.

Never use the products for an application involving serious risk to life or property without making sure that the system as a whole was designed to address the risks and that the Rockwell Automation product is properly rated and installed for the intended use within the overall equipment or system.

Follow Precautions for Use

ATTENTION

Safety state of the module and its data is defined as the off state.

Use the module in applications where the safety status for the module is off (0).

Serious injury may occur due to breakdown of safety outputs. Do not connect loads beyond the rated value to the safety outputs.

Serious injury may occur due to loss of required safety functions. Wire the module properly so that supply voltages or voltages for loads do **not** touch the safety outputs accidentally or inadvertently.

ATTENTION

Use dc supply satisfying the following requirements to prevent electric shock:

A dc power supply with double or reinforced insulation, for example, according to IED/EN 60950 or EN 50178 or a transformer according to IEC/EN 61558

A dc supply satisfies requirement for class 2 circuits or limited voltage/current circuit stated in UL 508

ATTENTION

Follow these precautions for safe use.

Wire conductors correctly and verify operation of the module before commissioning systems in which the module is incorporated. Incorrect wiring may lead to loss of safety function.

Do not apply dc voltages exceeding the rated voltages to the module.

Apply properly specified voltages to the module inputs. Applying inappropriate voltages causes the module to fail to perform its specified function, which leads to loss of safety functions or damage to the module.

Never use test outputs as safety outputs in any way. Test outputs are not safety outputs.

Note that after installation of the module, qualified personnel must confirm the installation and conduct trial operation and maintenance.

Note that a safety administrator familiar with the machine in which the module is to be installed must conduct and verify the installation.

Do not disassemble, repair, or modify the module. This may result in loss of safety functions.

Use only appropriate components or devices complying with relevant safety standards corresponding to the required safety category and safety integrity level.

Conformity to requirements of the safety category and safety integrity level must be determined for the entire system.

We recommend you consult a certification body regarding assessment of conformity to the required safety integrity level.

Note that you must confirm compliance with the applicable standards for the entire system.

Disconnect the module from the power supply before wiring. Devices connected to the module may operate unexpectedly if wiring is performed while power is supplied.

For 1791DS-IB4XOW4 modules, follow these instructions on isolating transformer use. Refer to the isolating transformer figure.

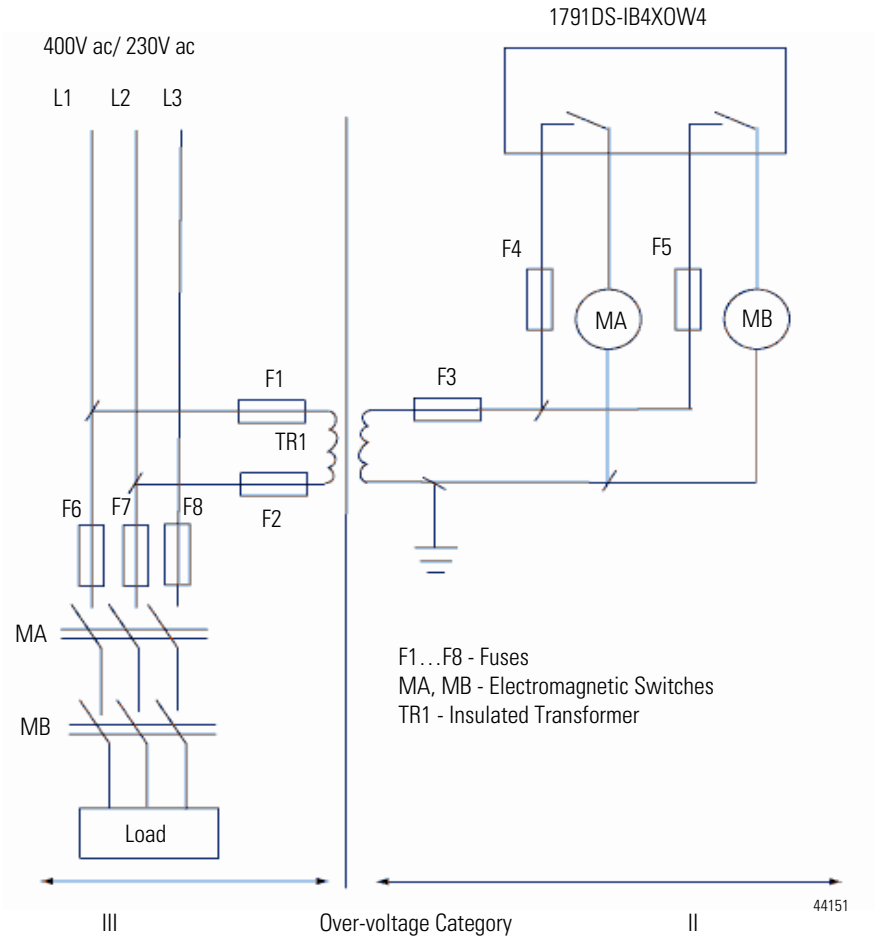
Use an isolating transformer to isolate between over-voltage category III and II, such as TR1, to conform to IEC 60742.

Be sure the insulation between first input and secondary output satisfies at least basic insulation of over-voltage category III.

Be sure one side of a secondary output of the isolating transformer is grounded to prevent electric shock to personnel due to a short to ground or short to the frame of the isolating transformer.

Insert fuses, in case of a short to the frame, to protect the isolating transformer and prevent electric shock to personnel, per transformer specifications, at points such as F1, F2, and F3.

Use of Isolating Transformer



Follow Precautions for Mounting, Wiring, and Cleaning

Observe these precautions to prevent operation failure, malfunctions, or undesirable effects on product performance.

When mounting modules, observe these precautions.

- Use DIN rail that is 35 mm (1.38 in.) wide to mount the module into the control panel.
- Mount modules to DIN rail so that the module does not fall off the DIN rail, for example, due to vibration.
- Leave at least 50 mm (1.96 in.) above and below the module to allow adequate ventilation and room for wiring for 1791DS-IB8, 1791DS-IB8XOB8, and 1791DS-IB4XOW4 modules.
- Leave at least 5 mm (0.6 in.) above and below the module to allow adequate ventilation and room for wiring for 1732DS-IB8, 1732DS-IB8XOBV4, and 1791DS-IB8XOBV4 modules.

When wiring modules, follow these instructions.

- Do not place communication lines and I/O lines in the same wiring duct or track as high voltage lines.
- Wire correctly after confirming the signal names of all terminals.
- Do not remove the shield from a module before wiring, but always remove the shield after completing wiring to be sure of proper heat dispersion for 1791DS-IB8, 1791DS-IB8XOB8, and 1791DS-IB4XOW4 modules.
- Use insulated post terminals (DIN 46228-4 standard) for stranded wires before connecting the wires.
- Tighten screws on communication and I/O connectors securely using a tightening torque of 0.25…0.3 Nm (2.16…2.59 lb-in).

When cleaning modules, do not use the following.

- Thinner
- Benzene
- Acetone

I/O Module Overview

The Guard I/O modules implement the CIP-safety protocol extensions over DeviceNet networks and provide various features for a safety system.

Use the modules to construct a safety-control network system that meets the requirements for Safety Integrity Level 3 (SIL 3) as defined in IEC 61508, Functional Safety of Electrical, Electronic, and Programmable Electronic Safety-related Systems, and the requirements for Safety Category 4 of the EN 954-1 standard.

Remote I/O communication for safety I/O data are performed through safety connections supporting CIP safety over a DeviceNet network, and data processing is performed in the safety controller.

The status and fault diagnostics of safety I/O modules is monitored by a safety PLC through a safety connection using a new or existing DeviceNet network.

Here is a list of features common to all Guard I/O modules.

CIP-safety protocol conformance

Safety inputs

- Contact output devices, such as emergency stop push buttons, gate switches, and safety light curtains, can be connected.
- Dual-channel mode evaluates consistency between two input signals (channels), which allows use of the module for Safety Category 4.
- The time of a logical discrepancy between two channels can be monitored using a discrepancy time setting.
- An external wiring short-circuit check is possible by turning on an input. The module must be wired in combination with test outputs when this function is used.
- Independently adjustable on and off delay is available per channel.

Test outputs

- Separate test outputs are provided.
- Broken wires detection is supplied on muting outputs.
- Power (24V) can be supplied to devices, such as safety sensors.
- Test outputs can be set as standard outputs for use as monitor outputs.
- All Guard I/O modules have numerous test outputs, of which some can be used for control and monitoring of a muting lamp.

Safety outputs

– Solid state outputs
  - Dual-channel mode evaluates consistency between two output signals (channels), which allows use of the module for Safety Category 4.
– Relay Outputs
  - Dual-channel mode evaluates consistency between two output signals (channels), which allows use of the module for Safety Category 4.
  - Up to 2 A is provided per output point.
  - Safety relays can be replaced.

I/O status data - In addition to I/O data, the module includes status data to check I/O circuits.

Security - The configuration information of the module can be protected by a password.

Removable I/O connectors - I/O connectors support mechanical keying.

About Catalog Numbers

See the table for a listing of the types of safety I/O modules.

Types of Safety I/O Modules

Catalog Number	Name	Enclosure Type Rating	Safety Inputs	Test Outputs[1]	Safety Outputs	
					Solid State	Relays
1732DS-IB8	Safety input module	Meets IP67	8	8	-	-
1732DS-IB8XOBV4	Safety I/O module with solid state outputs		8	8	4 bipolar pairs	-
1791DS-IB12	Safety input module	Meets IP20	12	4	-	-
1791DS-IB8XOB8	Safety I/O module with solid state outputs		8	4	8	-
1791DS-IB4XOW4	Safety I/O module with relay outputs		4	4	-	4
1791DS-IB8XOB4	Safety I/O module with solid state outputs		8	8	4 bipolar pairs	-

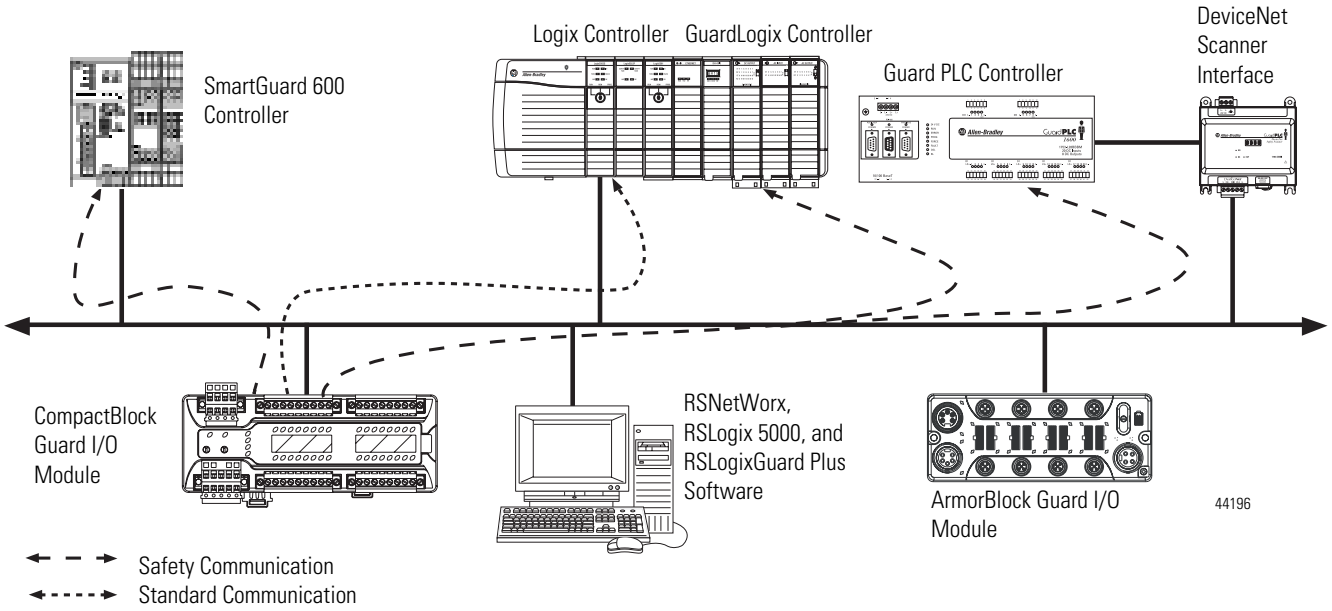
(1) Broken wires can be detected on the muting outputs.

About CIP Safety in DeviceNet Safety Architectures

Use Guard I/O modules in DeviceNet safety architectures as shown in the figure.

The Guard I/O family is a set of I/O modules that when connected to a DeviceNet safety network are suitable for applications up to SIL3, as defined in the IEC 61508 standard, and Safety Category 4, as defined in the EN 954-1 standard.

Guard I/O Modules in DeviceNet Safety Architectures



Safety input devices such as emergency-stop switches and safety output devices, such as safety contactors, can be connected to safety I/O blocks. Standard devices, such as proximity switches, pushbuttons, or lamps, can also be connected to safety I/O blocks.

Safety PLC controllers or safety network controllers control the safety outputs. Safety PLC controllers, safety network controllers, or standard PLC controllers can control the standard outputs.

The modules provide self-diagnostics to test the electronics within the module. The safety outputs provide a pulse test feature for diagnosing the external wiring of field actuators. Testing of input wiring is by connecting the field input devices to one of the pulse test outputs provided by the modules. Any pulse test outputs not used to test input wiring can be used as a standard output. At least one of these standard outputs is configurable with current monitoring to use it for control and monitoring of a muting lamp.

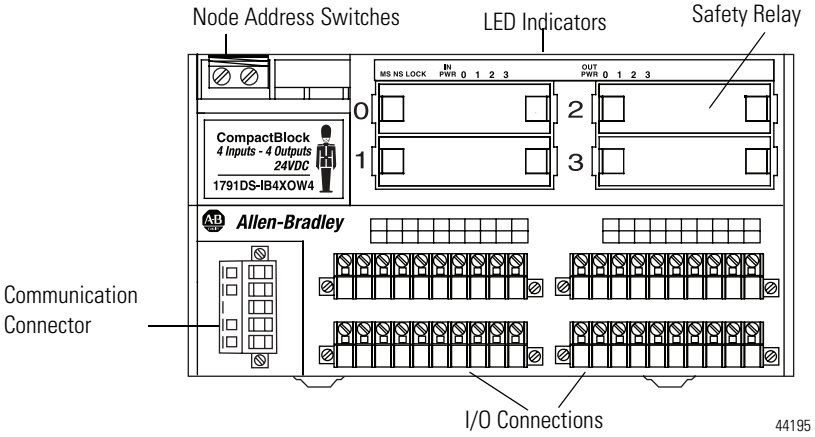
The modules also allow configuration of input points as dual inputs, and configuration of output points as dual outputs. The module performs internal diagnostics on I/O channels configured to operate in Dual mode.

Any discrepancy results in a safety state and status generated for the master. Configuration of DeviceNet Guard I/O modules is via software using either the network configuration tool, RSNetWorx for DeviceNet Safety software, or the PLC programming tool, RSLogix 5000 software.

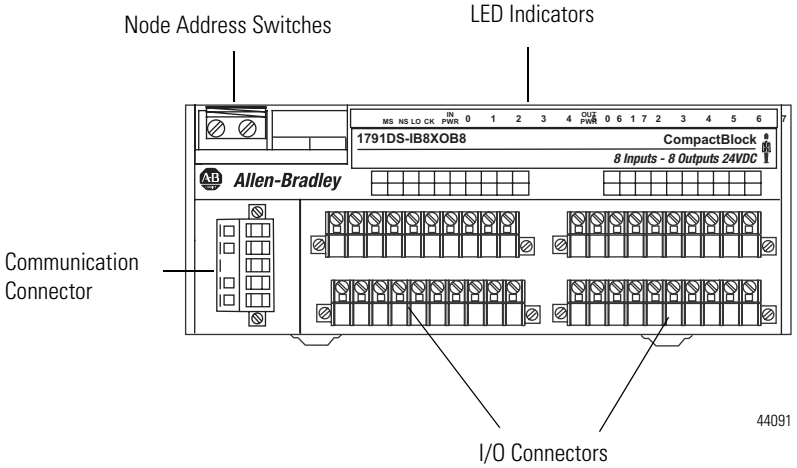
Identify Major Parts of the Modules

See the figures that show major parts of the modules.

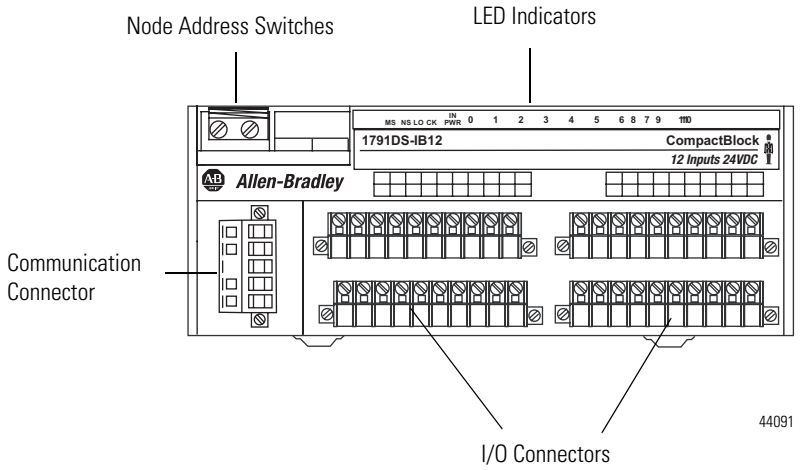
1791DS-IB4XOW4 Module Identification



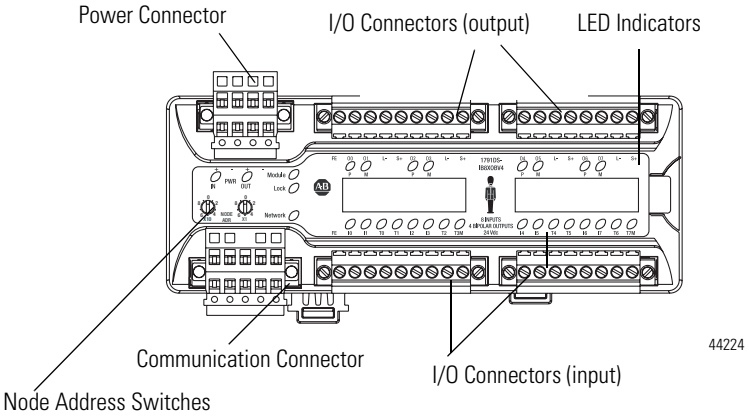
1791DS-IB8XOB8 Module Identification



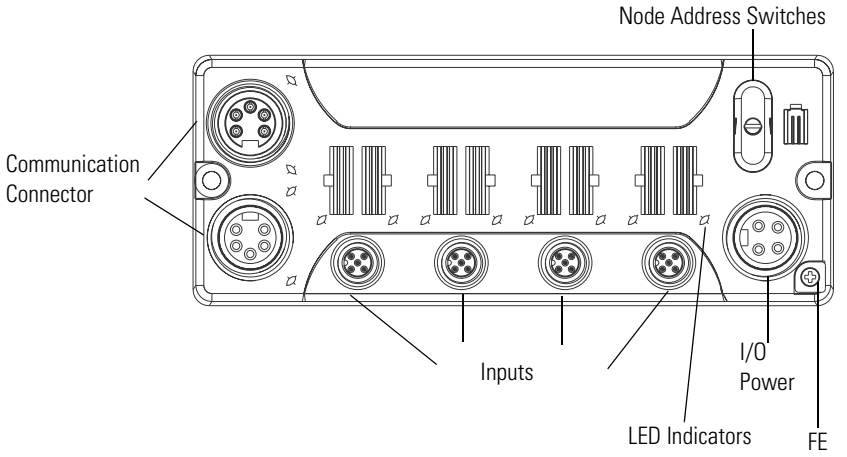
1791DS-IB12 Module Identification



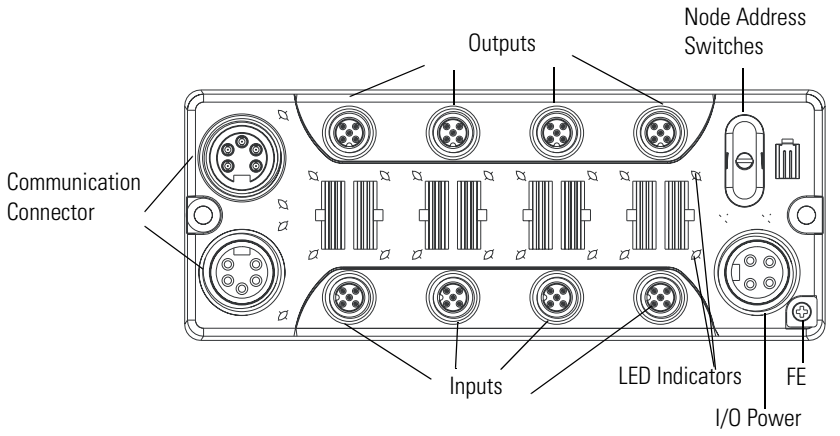
1791DS-IB8XOBV4 Module Identification



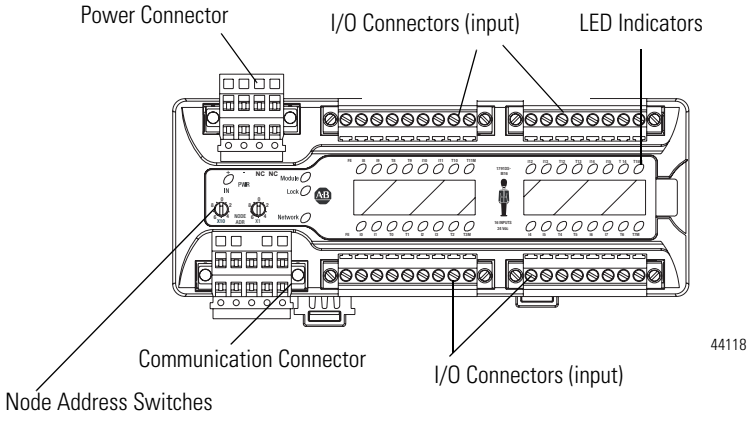
1732DS-IB8 Module Identification



1732DS-IB8XOBV4 Module Identification



1791DS-IB16 Module Identification



Understand the Operation of Safety Functions

What This Chapter Contains

Read this chapter for information related to the safety functions of the modules. Also included is a brief overview on international standards and directives that you should be familiar with.

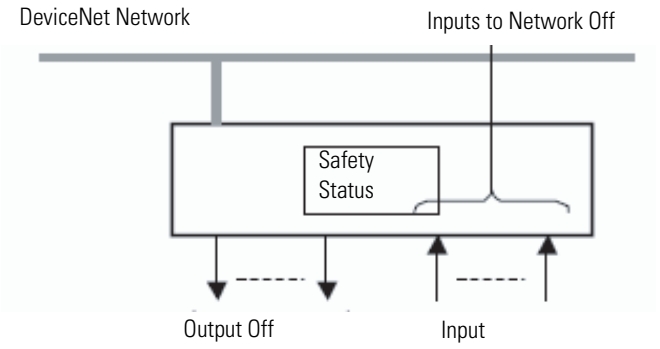
Safety I/O Modules

The following status is treated as the safety state by the safety I/O modules.

Safety outputs: off

Safety input data to network:off

Safety Status



The module is designed for use in applications where the safety state is when the outputs turn off.

Self-diagnostic Functions

Self-diagnostics are performed when the power is turned on and periodically during operation. If an error occurs, it is treated as a fatal error, the red module status (MS) indicator lights, and the safety outputs and output data to the network turn off.

Configuration Lock

After configuration data has been downloaded and verified, the configuration data within the module can be protected either by using RSNetWorx for DeviceNet or RSLogix 5000 software.

If the data is protected, the lock indicator on the front panel lights in solid yellow. If the data is not protected, the lock indicator on the front panel flashes in yellow.

Safety Inputs

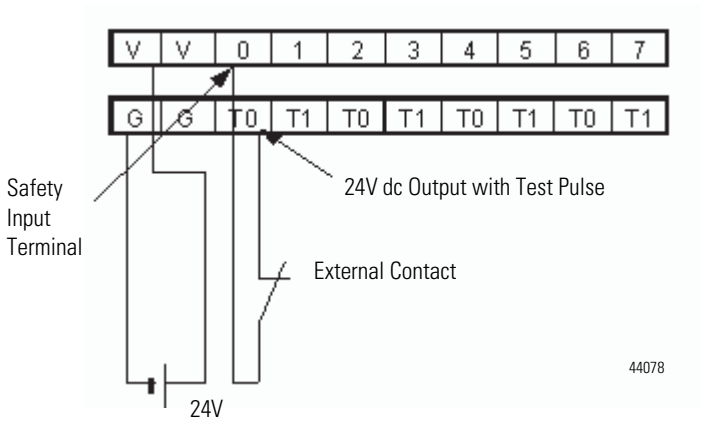
Read this section for information about safety inputs.

Test Pulse from Test Output

A test output is used in combination with a safety input. Specify the corresponding-test output terminal to use as the test source.

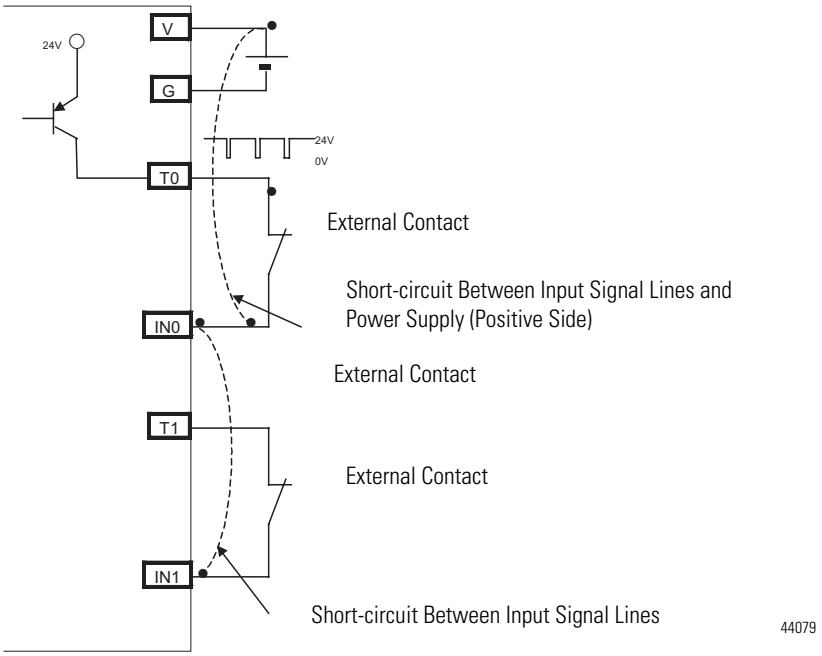
The test output terminal is also used as a power supply to source an external input device to the safety input terminal.

Example Use of a 1791DS-IB12 Module



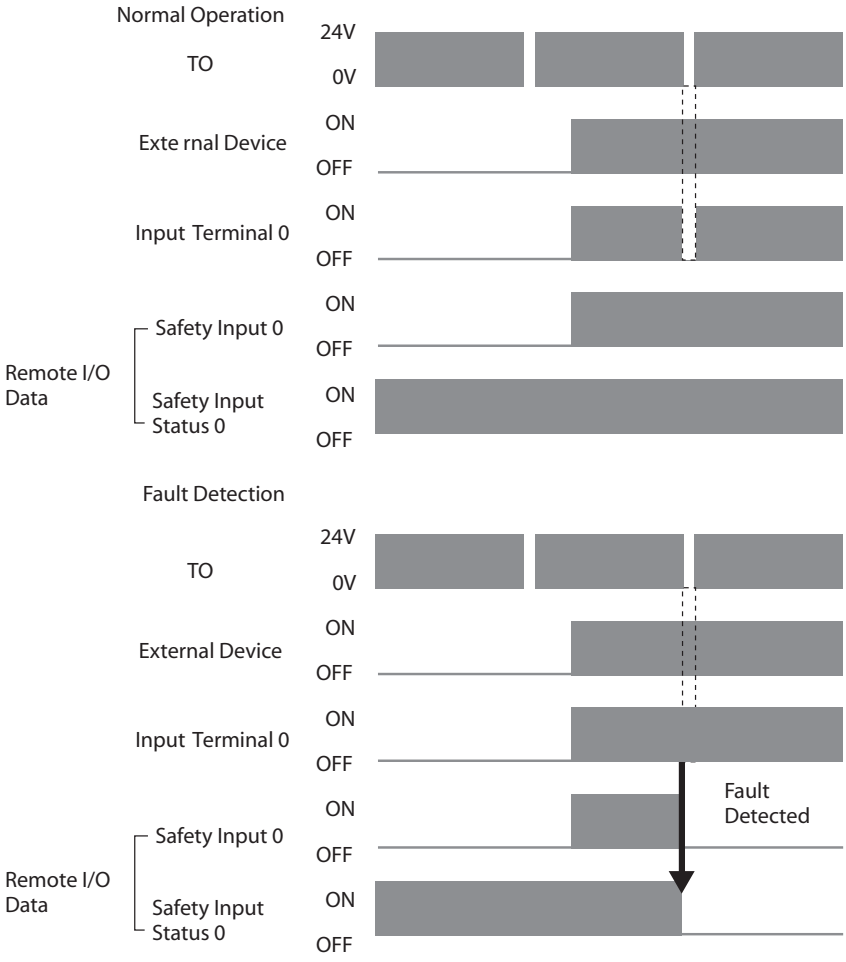
When the external input contact turns on, a test pulse is output from the test output terminal to diagnose the field wiring and input circuitry. Using this function, short-circuits between input signal lines and the power supply (positive side), and short-circuits between input signal lines can be detected.

Short-circuit Between Input Signal Lines



If an error is detected, safety input data and safety input status turn off.

Normal Operation and Fault Detection



Set Dual-channel Mode and Discrepancy Time

The consistency between signals on two channels can be evaluated. Either equivalent or complementary can be selected. This function monitors the time during which there is a discrepancy in the logic between the two channels set as dual channels.

If the length of the discrepancy exceeds the set discrepancy time (0…65,530 ms in increments of 10 ms), the safety input data and the individual-safety input status turns off for both inputs.

IMPORTANT The dual-channel function is used with two consecutive inputs that start from even input numbers such as inputs 0 and 1, inputs 2 and 3, and inputs 4 and 5.

The following table shows the relation between terminal input status and remote I/O data.

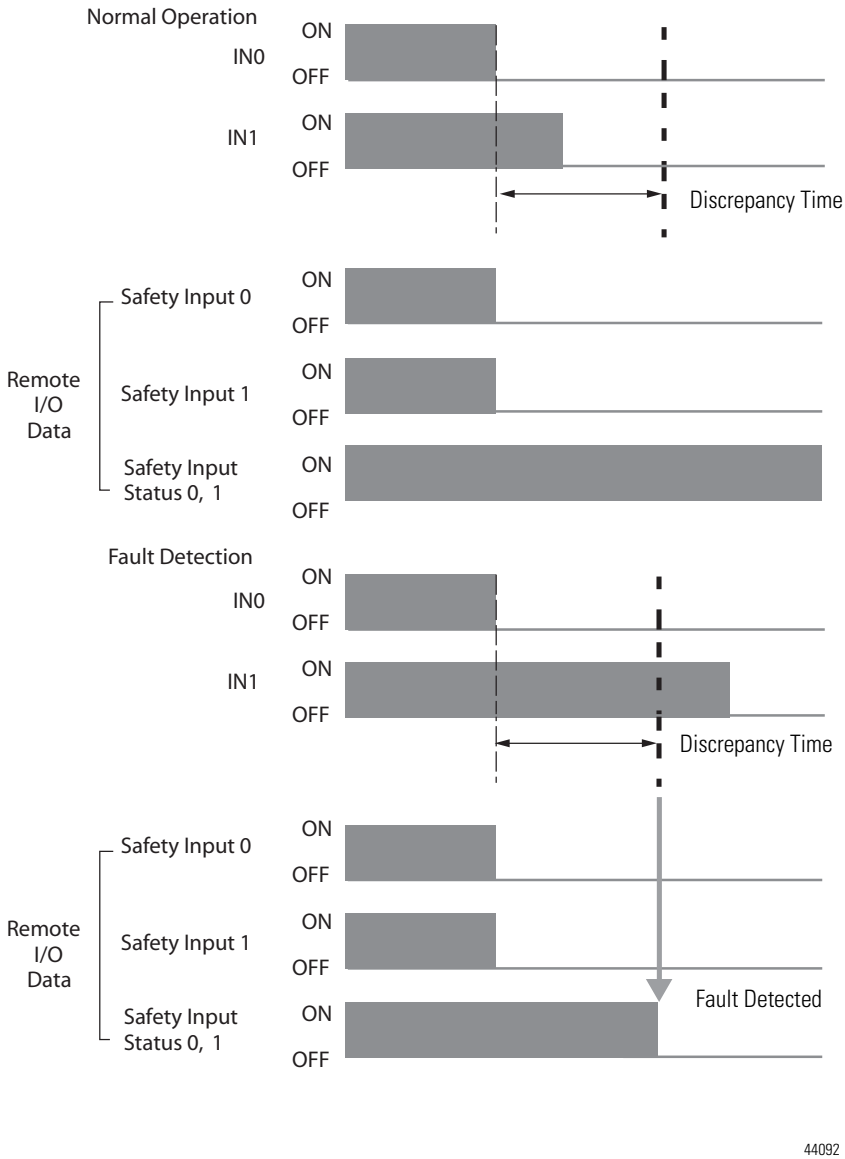
Terminal Input Status and Remote I/O Data

Dual-channel Mode	Input Terminal		Remote I/O Data				Meaning of Data and Status
	IN0	IN1	Safety Input 0	Safety Input 1	Status of Safety Input 0	Status of Safety Input 1	
Dual-channels, Equivalent	OFF	OFF	OFF	OFF	ON	ON	OFF, normal (OK)
	OFF	ON	OFF	OFF	OFF	OFF	OFF, fault
	ON	OFF	OFF	OFF	OFF	OFF	OFF, fault
	ON	ON	ON	ON	ON	ON	ON, normal (OK)
Dual-channels, Complementary	OFF	OFF	OFF	ON	OFF	OFF	OFF, fault
	OFF	ON	OFF	ON	ON	ON	OFF, normal (OK)
	ON	OFF	ON	OFF	ON	ON	ON, normal (OK)
	ON	ON	OFF	ON	OFF	OFF	OFF, fault

Dual-channels, Equivalent

The status is treated as normal (OK) when both channels are on or off. If one channel is on and the other channel is off, it is treated as a fault (alarm). In the fault (alarm) state, the safety input data and individual safety input status turn off for both inputs.

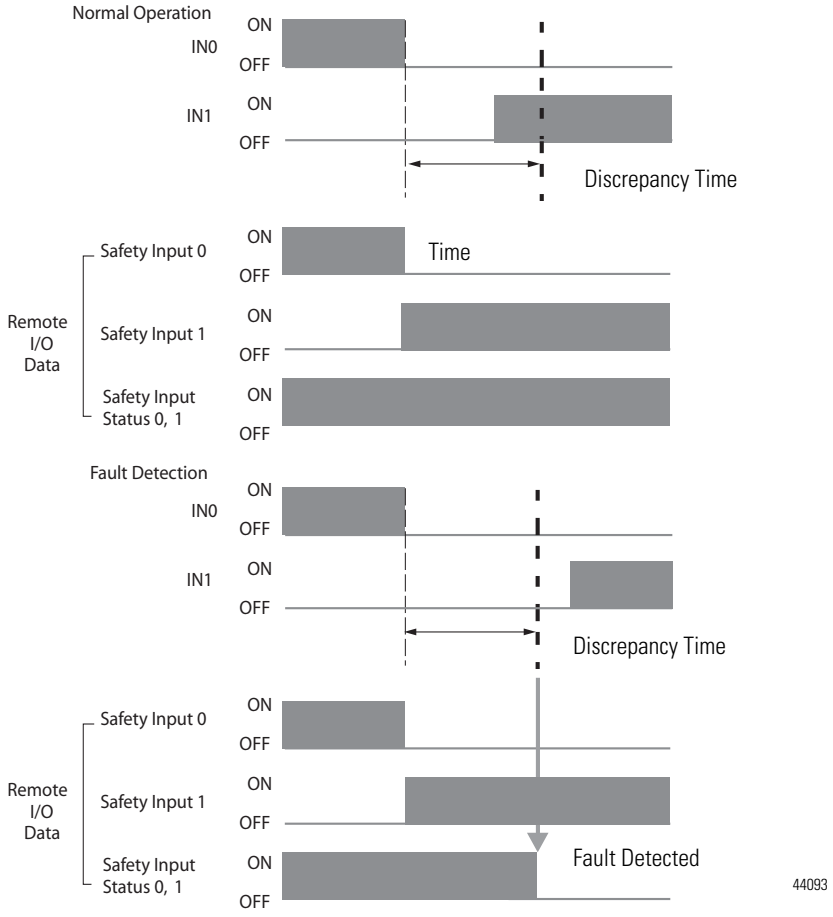
Normal Operation and Fault Detection



Dual-channels, Complementary

The status is treated as normal (OK) when one channel is on and the other channel is off. When both channels are on or both channels are off, it is treated as a fault (alarm). In the fault (alarm) state, safety input 0 is off and safety input 1 is off, and the safety input status turns off for both inputs.

Normal Operation and Fault Detection



Fault Recovery

If an error is detected, the safety input data remains in the off state. The procedure for activating the safety input data again is as follows.

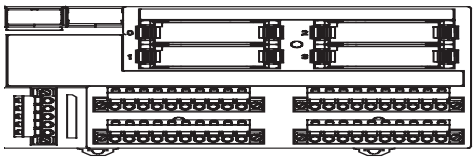
1. Remove the cause of the error.
2. Turn off the safety input.

   The safety input status turns on after the input-error latch time has elapsed. The I/O indicator (red) turns off. The input data can now be controlled.

Input Delays

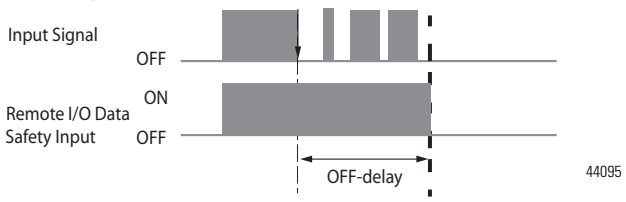
On-delay - An input signal is treated as being off during the on-delay setting time (0…126 ms, in increments of 6 ms) after the input contact's rising edge. The input turns on only if the input contact remains on after the on-delay time has elapsed. This helps prevent chattering of the input contacts.

On-delay



Off-delay - An input signal is treated as being on during the off-delay setting time (0…126 ms, in increments of 6 ms) after the input contact's falling edge. The input turns off only if the input contact remains off after the off delay time has elapsed. This helps prevent chattering of the input contacts.

Off-delay



Safety Outputs

Read this section for information about safety outputs.

Safety Output with Test Pulse

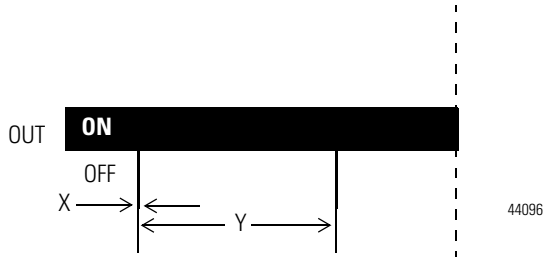
When the output is on, the test pulse is turned off in a cycle for a period of time as shown in the the table and figure.

Using this function, short-circuits between output signal lines and the power supply (positive side) and short-circuits between output signal lines can be detected. If an error is detected, the safety output data and individual-safety output status turns off.

Pulse Width and Period for X and Y

Attribute	1791DS-IB8XOB8	1791DS-IB8XOBV4, 1732DS-IB8XOBV4
Pulse width, X	700 us	500 us
Pulse period,Y	648 ms	600 ms

Test Pulse in a Cycle

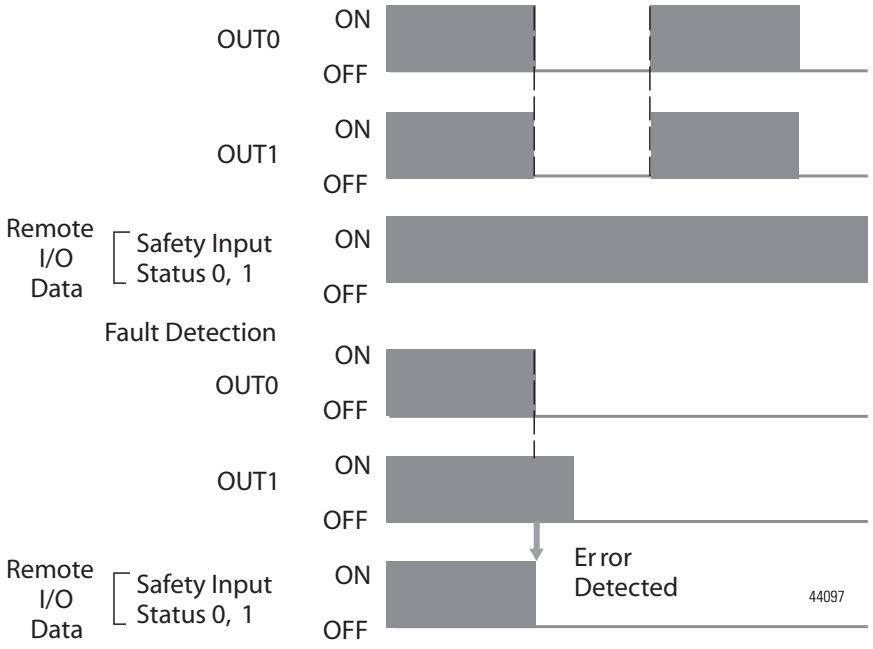


IMPORTANT To prevent the test pulse from causing the connected device to malfunction, pay careful attention to the input response time of the device.

Dual-channel Setting

When the data of both channels is in the on state, and neither channel has an alarm, the outputs are turned on. The status is treated as OK when both channels are OK. If an alarm is detected for one channel, the safety output data and the individual-safety output status turn off for both channels.

Dual-channel Setting



Fault Recovery

If a fault is detected, the safety output remains in the off state. The procedure for activating the safety output data again is as follows.

1. Remove the cause of the error.
2. Turn off the safety output or outputs.

   The safety output status turns on when the output-error latch time has elapsed. The I/O indicator (red) turns off. The output data can now be controlled.

I/O Status Data

In addition to I/O data, the module supports status data to check the I/O circuits. The status data includes the following data, which can be read by the PLC controllers.

Individual Point Input Status
(ON = Normal/OK, OFF = Fault/Alarm)

Combined Input Status
(ON = Normal/OK, OFF = Fault/Alarm)

Individual Point Output Status
(ON = Normal/OK, OFF = Fault/Alarm)

Combined Output Status
(ON = Normal/OK, OFF = Fault/Alarm)

Individual Output Readback
(actual ON/OFF state of the outputs)

Individual Test Output Status
(ON = Normal/OK, OFF = Fault/Alarm)

Normal flags indicate whether each safety input, safety output, or test output is normal (normal status: ON, error (fault) status: OFF). For fatal errors, communication connections may be broken, so the status of the normal flags then cannot be read.

Combined flags are provided for an AND of the status of all safety inputs or all safety outputs (when all inputs or outputs are normal: ON, when one or more of them has an error: OFF). This is known as the combined safety input/output status.

Output monitors indicate the actual ON/OFF status of each safety output.

Controlling Devices

See the table for sample requirements for controlling devices.

ATTENTION

Use appropriate devices as indicated in the Controlling Devices - Sample Requirements table. Serious injury may occur due to loss of safety functions.

Controlling Devices - Sample Requirements

Device	Requirement	Allen-Bradley Bulletin Safety Components
Emergency stop switches	Use approved devices with direct opening mechanisms complying with IEC/EN 60947-5-1.	Bulletin 800F, 800T
Door interlocking switches, limit switches	Use approved devices with direct opening mechanisms complying with IEC/EN 60947-5-1 and capable of switching microloads of 24V dc 3 mA.	Bulletin 440K, 440G, 440H for interlock switch Bulletin 440P, 802T for limit switch
Safety sensors	Use approved devices complying with the relevant product standards, regulations, and rules in the country where used.	Any Guardmaster product
Relays with forcibly-guided contacts, contactors	Use approved devices with forcibly-guided contacts complying with EN 50205. For feedback purposes, use devices with contacts capable of switching micro loads of 24V dc 3 mA.	Bulletin 700S, 100S
Other devices	Evaluate whether devices used are appropriate to satisfy the requirements of safety category levels.	-

Safety Precautions

ATTENTION

As serious injury may occur due to loss of required safety function, follow these safety precautions.

- Do not use test outputs of the modules as safety outputs.
- Do not use DeviceNet standard I/O data or explicit message data as safety data.
- Do not use LED indicators on the safety I/O modules for safety operations.
- Do not connect loads beyond the rated value to the safety outputs.
- Wire the safety I/O modules properly so that 24V dc line does not touch the safety outputs accidentally or unintentionally.
- Ground the 0V line of the power supply for external output devices so that the devices do not turn on when the safety output line is grounded.
- Clear previous configuration data before connecting devices to the network.
- Set suitable node addresses before connecting devices to the network.
- Perform user testing and confirm that all of the device configuration data and operation is correct before starting system operation.
- When replacing a device, configure the replacement device suitably and confirm that it operates correctly.
- When installing or replacing modules, clear any previous configuration before connecting input or output power to the device.

Legislation and Standards

Read this section to familiarize yourself with related legislation and standards information. Relevant international standards include the following:

IEC 61508 (SIL 1-3)
IEC 61131-2
IEC 60204-1
IEC 61000-6-2
IEC 61000-6-4

The modules received the following certification from ODVA, when product is marked.

DeviceNet Conformance Test
DeviceNet Safety Conformance Test

Europe

In Europe, Guard I/O modules are subject to the European Union (EU) Machinery Directive Annex IV, B, Safety Components, items 1 and 2. The type approval of TUV-Rheinland addresses compliance to applicable requirements of the following directives and standards:

EU legislation
- Machinery Directive 98/37/EC
- Low-voltage Directive 73/23/EEC
- EMC Directive 89/336/EEC

European standards
- EN 61508 (SIL1-3)
- EN 954-1 (Category 4, 3, 2, 1, B)
- EN 61131-2
- EN 418
- EN 60204-1
- IEC 61000-6-2
- IEC 61000-6-4

North America

In North America, the TUV-Rheinland type approval includes Guard I/O compliance to the relevant standards and related information including the following:

U.S. standards - ANSI RIA15.06, ANSI B11.19, NFPA 79

The modules are UL-certified functionally safe and carry the NRGF label, when product is marked.

The modules received UL Listing to standards of U.S. and Canada including the following, when product is marked:

UL 508, UL 1604, CSA 22.1 No.14, CSA 22.2 No. 213
(for 1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB8XOBV4, 1732-IB8XOBV4, 1732-IB modules)

UL 508, CSA 22.1 No. 14
(for 1791DS-IB4XOW4 modules)

Japan

In Japan, type test requirements are provided in Article 44 of the Industrial Safety and Health Law. These requirements apply to complete systems and cannot be applied to a module by itself. Accordingly, to use the module in Japan as a safety device for press machine or shearing tool pursuant to Article 42 of the above-mentioned law, it is necessary to apply for testing of the entire system.

EC Directives

DeviceNet products conform to the EMC Directive and Low-voltage Directive.

EMC Directive

Rockwell Automation devices that comply with EC directives also conform to the related EMC standards so that they can more easily be built into other devices or the overall machine. The actual products have been checked for conformity to EMC standards. Whether they conform to the standards in the system used by the customer, however, must be confirmed by the customer.

EMC-related performance of Rockwell Automation devices that comply with EC directives vary depending on the configuration, wiring, and other conditions of the equipment or control panel in which the Rockwell Automation devices are installed. The customer must, therefore, perform the final check to confirm that devices and the overall machine conform to EMC standards.

Compliance with EC Directives

DeviceNet products that comply with EC directives must be installed as follows.

All Type IP20 DeviceNet units must be installed within control panels.

Use reinforced insulation or double insulation for the dc power supplies used for the communication power supply, internal-circuit power supply, and the I/O power supplies.

DeviceNet products that comply with EC directives also conform to the Common Emission Standard (EN 50081-2). Radiated emission characteristics (10-m regulations) may vary depending on the configuration of the control panel used, other devices connected to the control panel, wiring, and other conditions. You must confirm that the overall machine or equipment complies with EC directives.

DeviceNet products that comply with EC directives must have configurations with less than 30 m (98.43 ft) of I/O wiring and less than 10 m (32.81 ft) of power supply wiring, which applies to the 1791DS-IB12, 1791DS-IB8XOB8, and 1791DS-IB4XOW4 modules.

The following examples show how to reduce noise.

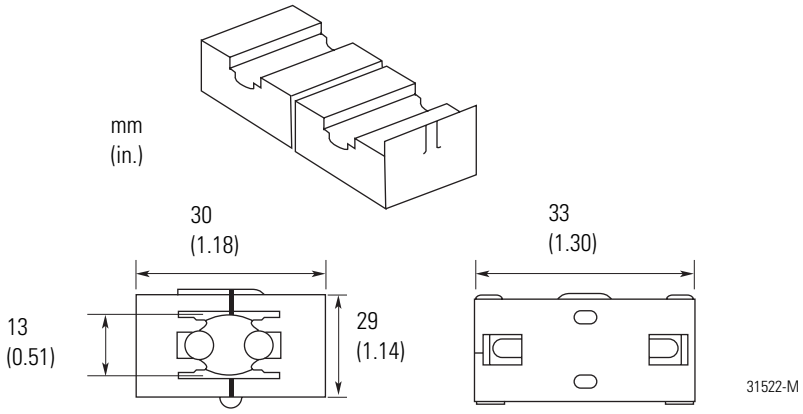
Reduce electrical noise from the communication cable by installing a ferrite core on the communication cable within 10 cm (3.93 in.) of the DeviceNet master unit.

Ferrite Core (Data Line Filter) LF130B
(manufactured by Easy Magnet Co.)

Impedance Specifications

Impedance	Value
25 MHz	100 MHz
156	250

Ferrite Core



Wire the control panel with cables that are as short as possible and ground to 100 or less.

Keep DeviceNet communication cables as short as possible and ground to 100 or less.

Install and Connect Your Modules

What This Chapter Contains

This chapter explains these general procedures for module use:

- Install the module in the control panel.
- Wire I/O power and cables.
- Connect communication connectors.
- Set the node address.
- Configure the system, making settings for the module.

The communication baud rate of the entire network is determined by the communication baud rate of the master unit. The communication baud rate does not need to be set for each module.

ATTENTION

Test Output points configured as Pulse Test or Power Supply become active whenever you apply network power and input power to the module. These configured functions are independent of the I/O connections to the module.

You can configure Test Outputs as Standard when they are used as standard outputs. You can connect Actuators to Test Output points that are expecting a Standard configuration.

If a module with Test Outputs configured as Pulse Test or Power Supply is incorrectly installed in an application where actuators are connected to these Test Output points, the actuators will be activated when network power and input power are applied.

To prevent this possibility, use the following procedures:

- When installing a module, be sure that the module is correctly configured for the application or in the out-of-box condition before applying input power.
- When replacing a module, be sure that the module is correctly configured for the application or in the out-of-box condition before applying input power.
- Reset modules to their out-of-box condition when removing them from an application.
- Be sure that all modules in replacement stock are in their out-of-box condition.

Install the Module

IMPORTANT

When installing a module follow these instructions.

Use the module in an environment that is within the general specifications.

Use the module in an enclosure rated IP54 (IEC60529) or higher.

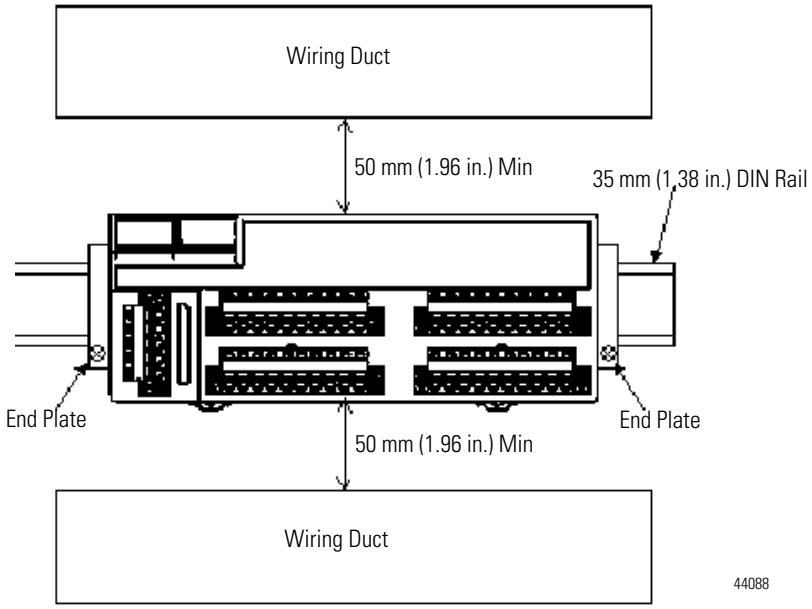
Use DIN rail that is 35 mm (1.38 in.) wide to mount the module in the control panel.

Always use an end plate on each end of the module to secure it for 1791DS-IB12, 1791DS-IB8XOB8, and 1791DS-IB4XOW4 modules.

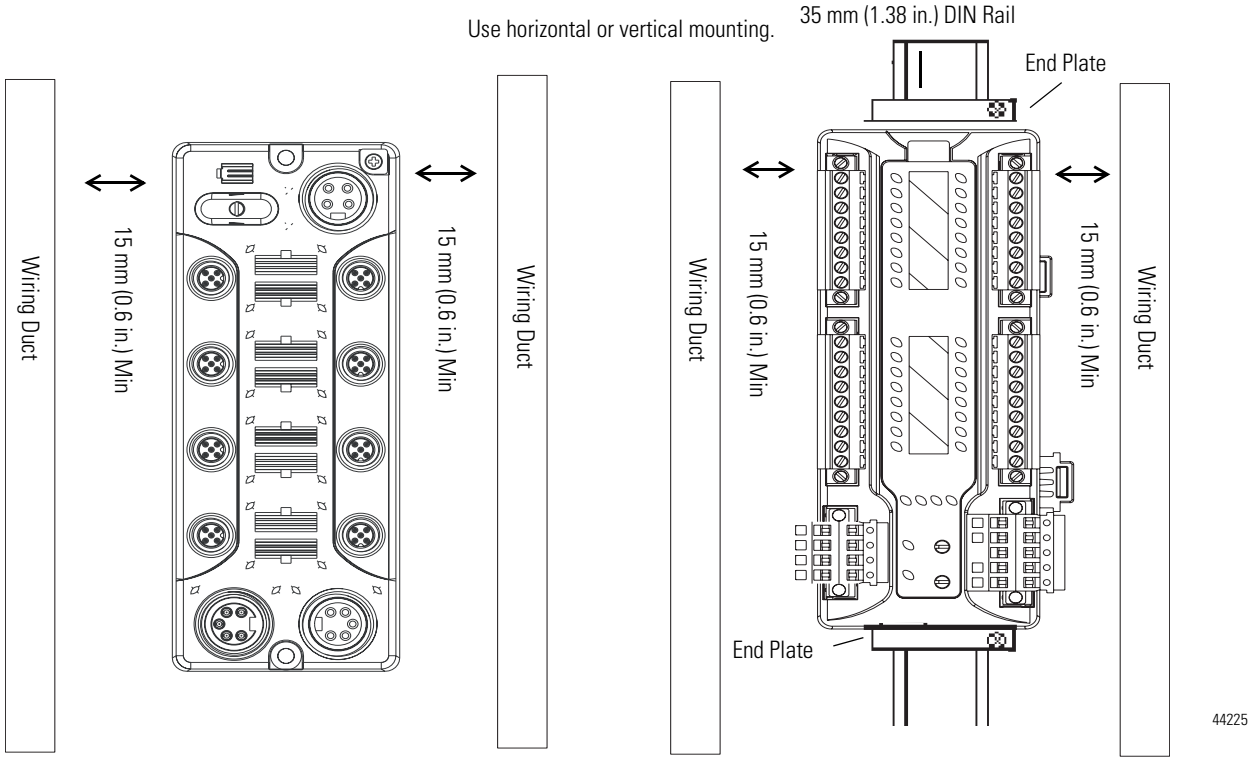
Place other heat sources an appropriate distance from the module to maintain the specified ambient temperatures around the module.

Use DIN rail that is 35 mm (1.38 in.) wide to install the module in the control panel. See the figures for required spacing.

Horizontal Module Installation



Vertical Module Installation (not including 1791DS-IB12, 1791DS-IB8XOB8, and 1791DS-XOW4 modules)



1732DS-IB8XOBV4 module is shown.
1732DS-IB8 modules have identical dimensions.

1791DS-IB8XOBV4 module is shown.
1791DS-IB16 modules have identical dimensions.

Connect I/O Power and I/O Cables

See the table for a list of applicable wires that fit the I/O connector when using recommended post-crimp terminals.

Wire Type and Size

Wire Type	Wire Size
Solid wire	0.2…2.5 mm^2 (AWG 24…12)
Stranded wire	0.34…1.5 mm^2 (AWG 22…16)

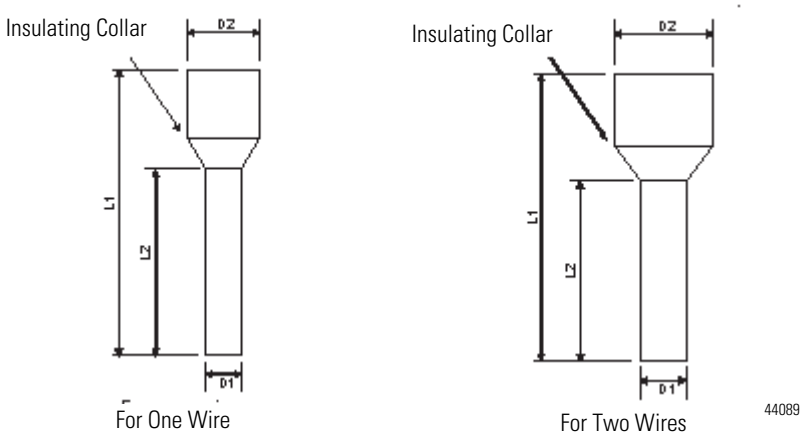
Use ferrules with plastic insulating collars conforming to DIN46228-4. Note that a ferrule with similar appearance but not conforming to the standard may not match the terminal block of the module. Confirm wire dimensions, noting that wire dimensions shown in the figure are rough dimensions.

IMPORTANT Use wires of the same diameter for any two-wire ferrules that are used.

Reference Specifications (Product Specifications of Phoenix Contact)

Ferrule Model		Wire Dimensions		Ferrule Specifications					
		Cross-sectional Area of Conductor (mm^2)	AWG	Removed Length of Insulation mm (in.)	Entire Length L1 mm (in.)	Length of Metal Part L2 mm (in.)	Inner Diameter of Conductor D1 mm (in.)	Inner Diameter of Insulation Cover D2 mm (in.)	Dimensions
For One Wire	AI 0.34-8TQ	0.34	22	10 (0.39)	12.5 (0.49)	8 (0.31)	0.8 (0.03)	2.0 (0.08)	See figure for one wire.
	AI 0.5-8WH	0.5	20	10 (0.39)	14 (0.55)	8 (0.31)	1.1 (0.04)	2.5 (0.09)	
	AI 0.75-8GY	0.75	18	10 (0.39)	14 (0.55)	8 (0.31)	1.3 (0.05)	2.8 (0.11)	
	AI 1.0-8RD	1.0	18	10 (0.39)	14 (0.55)	8 (0.31)	1.5 (0.06)	3.0 (0.12)	
	AI 1.5-8BK	1.5	16	10 (0.39)	14 (0.55)	8 (0.31)	1.8 (0.07)	3.4 (0.13)	
For Two Wires	AI-TWIN 2 x 0.5-8WH	2 x 0.5	-	10 (0.39)	15 (0.59)	8 (0.31)	1.5 (0.06)	2.5/4.7 (0.09/0.18)	See figure for two wires.
	AI-TWIN 2 x 0.75-8GY	2 x 0.75	-	10 (0.39)	15 (0.59)	8 (0.31)	1.8 (0.07)	2.8/5.0 (0.11/0.19)	
	AI-TWIN 2 x 1-8RD	2 x 1	-	10 (0.39)	15 (0.59)	8 (0.31)	2.05 (0.080)	3.4/5.4 (0.13/0.21)	

Ferrule for One Wire and Two Wires



Use a Phoenix Contact crimping tool (model CRIMPFOX UD6) for the ferrules.

IMPORTANT When crimping connection cables, follow these instructions.

- Use ferrules when wiring cables.
- Note that I/O connectors are detachable.
- Tighten the screws on the I/O connector to 0.25…0.3 Nm (2.16…2.59 lb-in).
- Since the I/O connector has a structure that helps prevent incorrect wiring, make connections at the specified locations corresponding to the terminal numbers.
- Do not remove the shield from the module before wiring.
- Always remove the shield after completing wiring to be sure of proper heat dispersion.

Connect Communication Connectors

Colored stickers on the communication connector match the colors of the wires to be inserted. Check that the colors of the wires and stickers match when wiring the connectors. The colors are as follows.

Colors and Signals

Color	Signal
Red	Power cable positive side (V+)
White	High side of communication data (CAN_H)
-	Shield
Blue	Low side of communication data (CAN_L)
Black	Power cable negative side (V-)

IMPORTANT When connecting a communication connector with the module, tighten the screws on the communication connector to 0.25…0.3 Nm (2.16…2.59 lb-in).

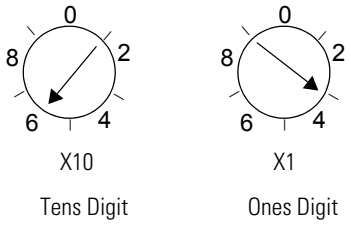
The internal power for the module is supplied from the communication power supply (V+, V-).

Set the Node Address

To set the node address, follow these procedures.

IMPORTANT The node-address setting rotary switches must be set while the communication power supply is turned off.

Sample Node Address Digits



1. Set the node address using the two rotary switches on the front panel of the module, noting that the default setting is 63 and a value between 00…63 is valid for proper use.
2. Use the left rotary switch to set the tens digit of node address (decimal).
3. Use the right rotary switch to set the ones digit.

If a node address from 64…99 is set, the node address can be set from RSNetWorx for DeviceNet software.

Configure the Module

Configure the module using RSNetWorx for DeviceNet or RSLogix 5000 software.

You can refer to this manual the corresponding-module configuration software tool and its help files in RSLogix 5000 or RSNetWorx for DeviceNet software.

Configure Modules in RSLogix 5000 Software

What This Chapter Contains

This chapter provides information about how to configure your modules in RSLogix 5000 software.

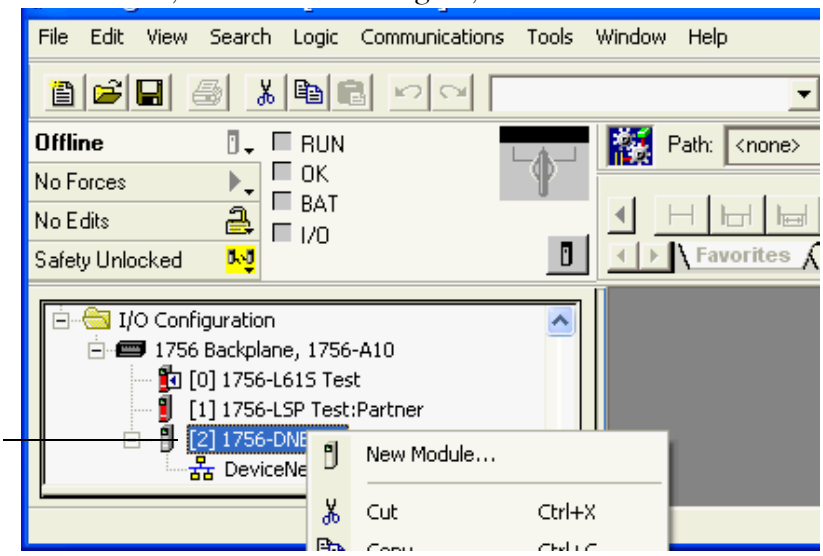
Use the Help Button

At the bottom of a dialog, click Help for information about how to complete entries on the dialog. At the bottom of a warning dialog, click Help to get information about that specific error.

Add Safety Modules to the I/O Configuration Tree

To add a safety module to the I/O configuration tree, follow this procedure.

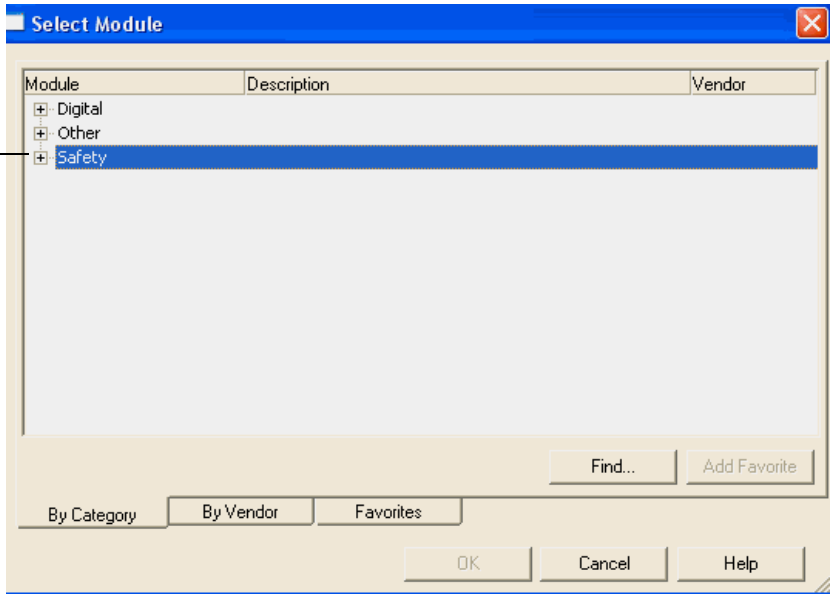
1. From the I/O Configuration tree, right-click the 1756-DNB module, as shown in the figure, and select New Module.



From the I/O Configuration tree, right-click the 1756-DNB module and select New Module.

You see the Select Module dialog with a list that includes Safety.

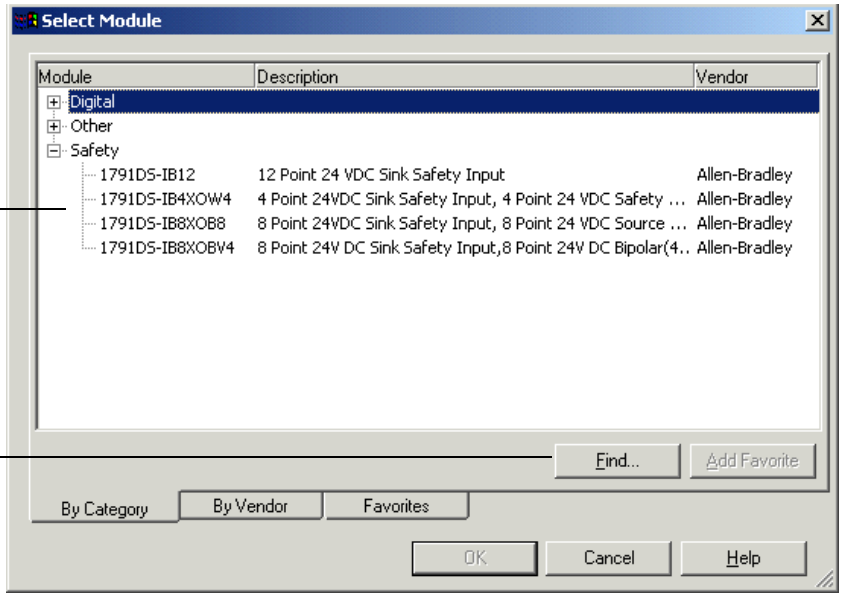
From the Select Module dialog, click + next to Safety to see a list of modules.



2. From the Select Module dialog, click the + next to Safety to see a list of safety modules.

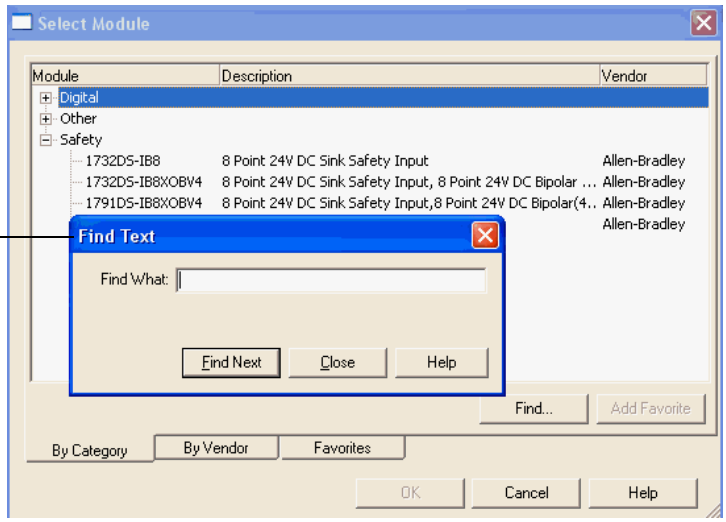
A list of safety modules appears here.

Click Find if desired.



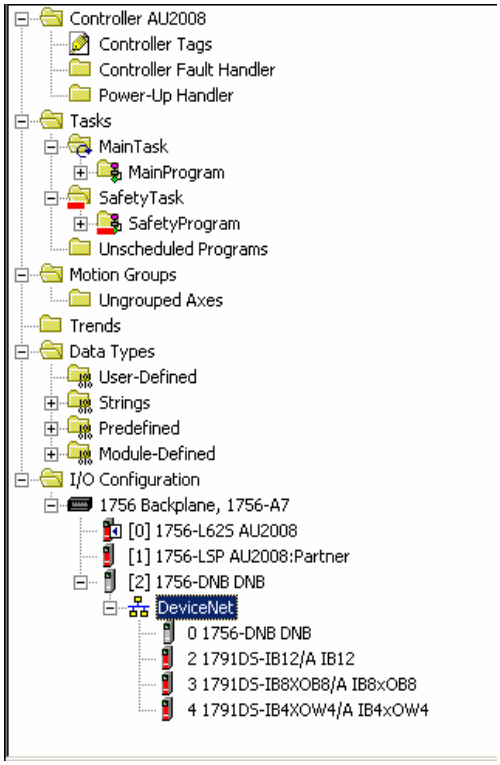
3. If desired, from the Select Module dialog that shows the list of modules, click Find, enter text, and click Find Next to find the text in the list of modules.

From the Find Text dialog, type text and click Find Next.



4. From the Select Module dialog, click the appropriate module, such as 1791DS-IB8, and OK at the bottom of the dialog.

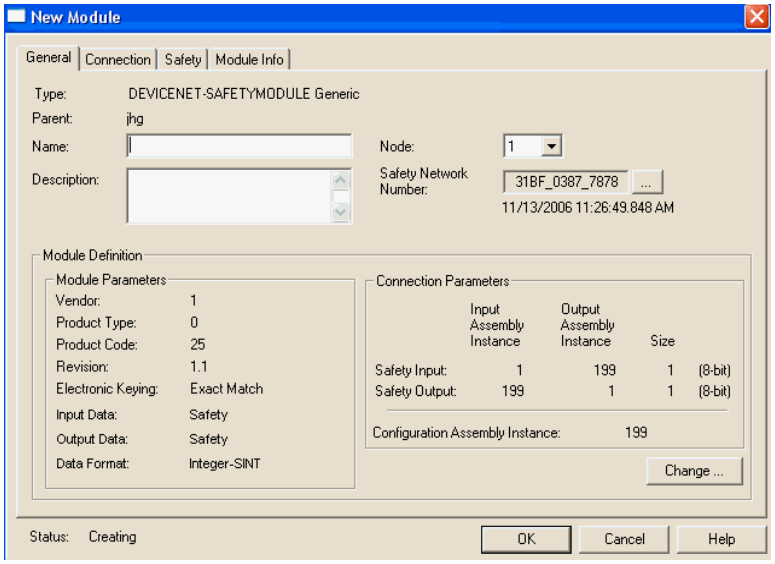
The module appears in the I/O configuration tree.



Use the Module Properties and General Dialogs

To use the Module Properties and General dialogs to configure a safety module, follow this procedure.

1. From the I/O configuration tree, double-click the safety module, such as the 1791DS-IB12 module, to see the Module Properties dialog.



2. From the Module Properties dialog, complete entries for the General dialog.

A. For Name, type a unique name.

B. For Node, select the DeviceNet Node number, noting this number and the switches on the actual modules must match.

C. For Description, if desired, type a description.

For a detailed explanation of the safety network number (SNN), see the GuardLogix Controller Systems Safety Reference Manual, publication 1756-RM093, noting that in most cases, you use the default provided by the RSLogix 5000 software.

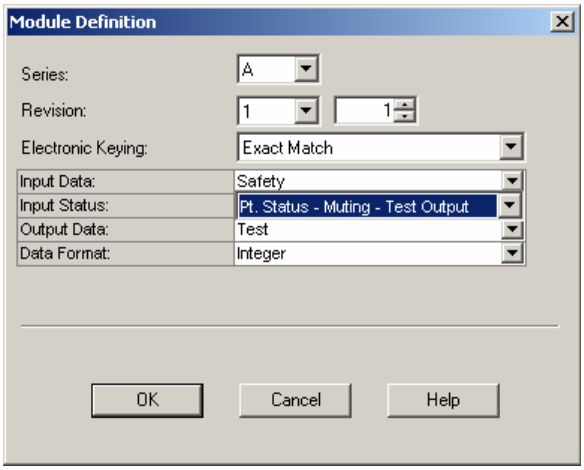
Read the following for an overview explanation of why the safety network number exists for DeviceNet safety.

> The purpose of a SNN is to make sure that every module in a system can be uniquely identified.

For example, assume there are two identical GuardLogix control systems - system A and system B - that are connected to a common Ethernet network. Each GuardLogix control system has three DeviceNet networks with assorted standard and safety I/O modules. In a system like this, modules can have the same node number, but no two modules have the same SNN and node number combination.
If 1756-DNB modules were in the same chassis, and the DeviceNet cables were inadvertantly disconnected, if reattached incorrectly, the connections to the safety modules are broken, because the 1756-DNB module is now connected to devices with a different SNN.

Note that we suggest that all safety modules on a network have the same SNN. This makes documentation easier. During configuration, RSLogix 5000 software defaults a safety device's SNN to match the SNN of the lowest safety node on the network.

D. Click Change to see the Module Definition dialog.



E. From the Module Definition dialog, select values to configure what data and status tags to generate implicitly for the safety module, noting that you can configure Input Data, Input Status, and Output Data.

Input Data Options

Choose from these options:

Safety - Selecting Safety creates these tags for the target module:

- RunMode: Module mode
- ConnectionFaulted: Communications status
- Safety Data: Safety inputs from module

IB8xOB8:I	{...}	{...}		AB:1791DS_IB8X...	Safety
IB8xOB8:I.RunMode	0		Decimal	BOOL	Safety
IB8xOB8:I.ConnectionFaulted	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt00Data	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt01Data	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt02Data	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt03Data	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt04Data	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt05Data	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt06Data	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt07Data	0		Decimal	BOOL	Safety

Safety-Readback - This selection is not available for input-only safety modules. Selecting Safety-Readback creates both safety and readback tags, with readback indicating the presence of 24V on the output terminal.

IB8xOB8:I.Pt00Readback	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt01Readback	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt02Readback	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt03Readback	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt04Readback	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt05Readback	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt06Readback	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt07Readback	0		Decimal	BOOL	Safety

Small Safety - This selection is for 12-point safety input modules that use 8 or fewer safety inputs. The selection reduces the amount of data the 12-point module sends to the controller to improve network performance. Safety data and point status tags are created. Point status is diagnostic status for each of the 8 input points.

IB12:I	{...}	{...}		AB:1791DS_IB12...	Safety
IB12:I.RunMode	0		Decimal	BOOL	Safety
IB12:I.ConnectionFaulted	0		Decimal	BOOL	Safety
IB12:I.Pt00Data	0		Decimal	BOOL	Safety
IB12:I.Pt01Data	0		Decimal	BOOL	Safety
IB12:I.Pt02Data	0		Decimal	BOOL	Safety
IB12:I.Pt03Data	0		Decimal	BOOL	Safety
IB12:I.Pt04Data	0		Decimal	BOOL	Safety
IB12:I.Pt05Data	0		Decimal	BOOL	Safety
IB12:I.Pt06Data	0		Decimal	BOOL	Safety
IB12:I.Pt07Data	0		Decimal	BOOL	Safety
IB12:I.Pt00Status	0		Decimal	BOOL	Safety
IB12:I.Pt01Status	0		Decimal	BOOL	Safety
IB12:I.Pt02Status	0		Decimal	BOOL	Safety
IB12:I.Pt03Status	0		Decimal	BOOL	Safety
IB12:I.Pt04Status	0		Decimal	BOOL	Safety
IB12:I.Pt05Status	0		Decimal	BOOL	Safety
IB12:I.Pt06Status	0		Decimal	BOOL	Safety
IB12:I.Pt07Status	0		Decimal	BOOL	Safety

Input Status Options

Choose from these options:

IMPORTANT	Status data is not SIL 3 data. Do not use status data to directly control a SIL 3 safety output.

None - No status tags, only data for the inputs

Point Status - One status tag for each input and output point

IB8xOB8:I.Pt00InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt01InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt02InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt03InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt04InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt05InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt06InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt07InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt00OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt01OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt02OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt03OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt04OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt05OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt06OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt07OutputStatus	0		Decimal	BOOL	Safety

Point Status-Muting - A muting status tag for test output T3 with point status for each input and output point

IB8xOB8:I.Pt00InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt01InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt02InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt03InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt04InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt05InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt06InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt07InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt00OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt01OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt02OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt03OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt04OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt05OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt06OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt07OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.MutingStatus	0		Decimal	BOOL	Safety

Combined Status-Muting

– A single BOOL tag represents an AND of the status bits for all the input points. For example, if any input channel has a fault, this bit goes LO.(1)
– A single BOOL tag represents an AND of the status bits for all the output points.(1)
– A muting status tag for test output T3.

IB8xOB8:I.OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.MutingStatus	0		Decimal	BOOL	Safety

Point Status-Muting-Test Output

– Status tags for each of the input and output points.
– Muting status tag for test output T3.
– Status tags for each of the test outputs.

IB8xOB8:I.Pt00InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt01InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt02InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt03InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt04InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt05InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt06InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt07InputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt00OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt01OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt02OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt03OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt04OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt05OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt06OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt07OutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt00TestOutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt01TestOutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt02TestOutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt03TestOutputStatus	0		Decimal	BOOL	Safety
IB8xOB8:I.MutingStatus	0		Decimal	BOOL	Safety

(1) When using combined status, use explicit messaging to read individual point status for diagnostic purposes.

Output Data Options

Choose from these options.

IMPORTANT	The standard outputs on the module must not be used for safety purposes.

None - Selecting None results in a Listen-only connection to the module. Inputs and status are read, but no outputs are written.

Safety - Selecting Safety creates these safety tags and enables these outputs for use in the safety task.

IB8xOB8:O	{...}	{...}		AB:1791DS_IB8X...	Safety
IB8xOB8:O.Pt00Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Pt01Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Pt02Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Pt03Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Pt04Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Pt05Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Pt06Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Pt07Data	0		Decimal	BOOL	Safety

Test - Selecting Test creates these tags and enables the four standard outputs on the module. These outputs are **standard** outputs and must not be used for safety purposes.

IB8xOB8:O	{...}	{...}		AB:1791DS_IB8X...	Safety
IB8xOB8:O.Test00Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Test01Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Test02Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Test03Data	0		Decimal	BOOL	Safety

Combined - Selecting Combined creates these tags and enables all module outputs - safety and standard.

IB8xOB8:O	{...}	{...}		AB:1791DS_IB8X...	Safety
IB8xOB8:O.Pt00Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Pt01Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Pt02Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Pt03Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Pt04Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Pt05Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Pt06Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Pt07Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Test00Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Test01Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Test02Data	0		Decimal	BOOL	Safety
IB8xOB8:O.Test03Data	0		Decimal	BOOL	Safety

Values and States of Tags

This table shows the values and states of the tags.

Data		Description
Input data	Safety Input Data SAFETY	Indicates the ON/OFF status of each input terminal. ON: 1 OFF: 0
	Combined Safety Input Status SAFETY	An AND of the status of all input terminals. All terminals are normal: 1 An error was detected in one or more input terminals: 0
	Individual Safety Input Status SAFETY	Indicates the status of each input terminal. Normal (OK): 1 Fault (Alarm): 0
	Combined Safety Output Status SAFETY	An AND of the status of all safety output terminals. All terminals are normal: 1 An error has been detected in one or more output terminals: 0
	Individual Safety Output Status SAFETY	Indicates the status of each safety output terminal. Normal (OK): 1 Fault (Alarm): 0
	Muting Lamp Status SAFETY	Indicates the status when terminal T3 is configured as the muting lamp output. Normal (OK)I: 1 Fault (Alarm): 0
	Output Readback STANDARD	Monitors the presence of 24V on the output terminal. Readback is ON (1) if 24V is on output terminal. ON: 1 OFF: 0
	Individual Test Output Status STANDARD	Indicates the status of each of the test output terminals. Normal (OK): 1 Fault (Alarm): 0
Output data	Safety Output Data SAFETY	Controls the safety output. ON: 1 OFF: 0
	Standard Output Data STANDARD	Controls the test output when Test Output mode is set to a standard output. ON: 1 OFF: 0

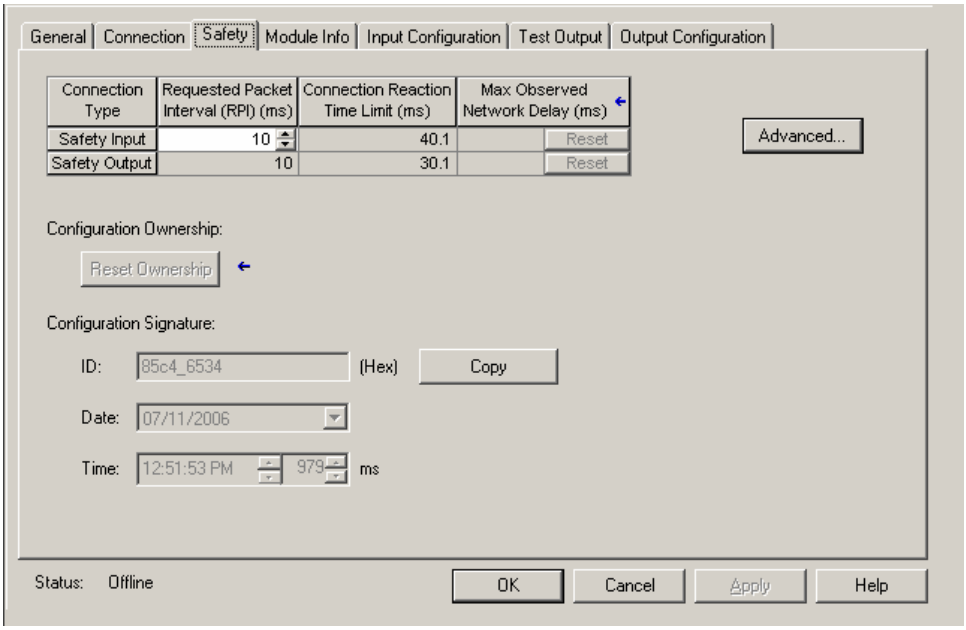
Safety denotes information the controller can use in safety-related functions. Standard denotes additional information that must not be relied on for safety functions.

IMPORTANT Note that all status (diagnostic) data is considered to be standard data and must not directly control a SIL 3 safety output. There are settings where standard data is part of a safety tag. This is done to make communication more efficient and to reduce controller overhead.

Work with the Safety Dialog

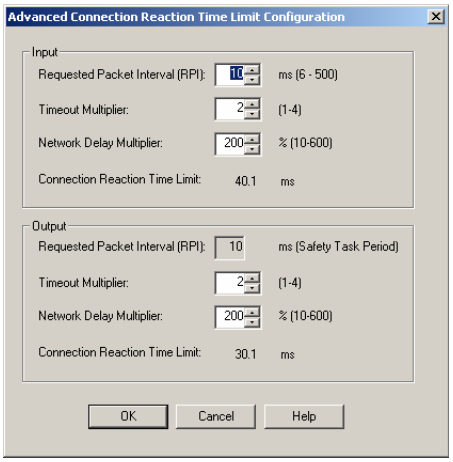
Read this for information about how to complete entries when you click Safety at the top of the Module Properties dialog.

1. From the Module Properties dialog, click Safety to see the Safety dialog.



2. Configure Requested Packet Interval (RPI) and Configure Connection Reaction Time Limit (CRTL) by following this procedure.

A. From the Safety dialog, click Advanced to see the Advanced Connection Reaction Time Limit Configuration dialog.



We recommend that you keep the Timeout Multiplier and Network Delay Multiplier at their default values of 2 and 200.

See GuardLogix Controllers User Manual, publication number 1756-UM020, for more information about the CRTL.

Make sure that input modules are set to match the need. The smallest input RPI allowed is 6 ms. Selecting small RPI's consumes network bandwidth and may cause nuisance trips because other devices can't get access to the network.

As an example, a safety input module with only ESTOP switches connected to it generally may work well with settings of 50…100 ms. An input module with a light curtain guarding a hazard may need the fastest response that is possible.

Selecting appropriate RPI's will result in a system with maximum (best) performance.

IMPORTANT	You should always analyze each safety channel to determine what is appropriate. These examples are simply to convey concepts and should not be used as any kind of official recommendation.

A connection status tag exists for every connection.

Connection Faulted

IB8xOB8:I	{...}	{...}		AB:1791DS_IB8X...	Safety
IB8xOB8:I.RunMode	0		Decimal	BOOL	Safety
IB8xOB8:I.ConnectionFaulted	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt00Data	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt01Data	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt02Data	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt03Data	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt04Data	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt05Data	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt06Data	0		Decimal	BOOL	Safety
IB8xOB8:I.Pt07Data	0		Decimal	BOOL	Safety

If the RPI and CRTL for the network are set appropriately, then this status tag will always remain HI. Monitor all connection status bits to verify that they are not going LO intermittently due to timeouts.

The configuration signature is created by RSLogix 5000 software and verified by the safety module. The configuration signature provides SIL 3 integrity of the configuration of a 1791DS module.

When a GuardLogix first connects to a 1791DS module, the complete configuration is downloaded to the I/O module.

Any time the GuardLogix controller attempts to connect to a 1791DS module, if the configuration signatures are the same, then the configuration does not need to be downloaded, because they already match.

Any time the GuardLogix controller attempts to connect to a 1791DS module and the signatures do not match, the module will check the module node number, keying, and safety network number. If these are all correct, the controller will attempt to configure the module.

Work with the Input Configuration Dialog

See the table that shows typical safety input parameters, referring to Chapter 2 for related information.

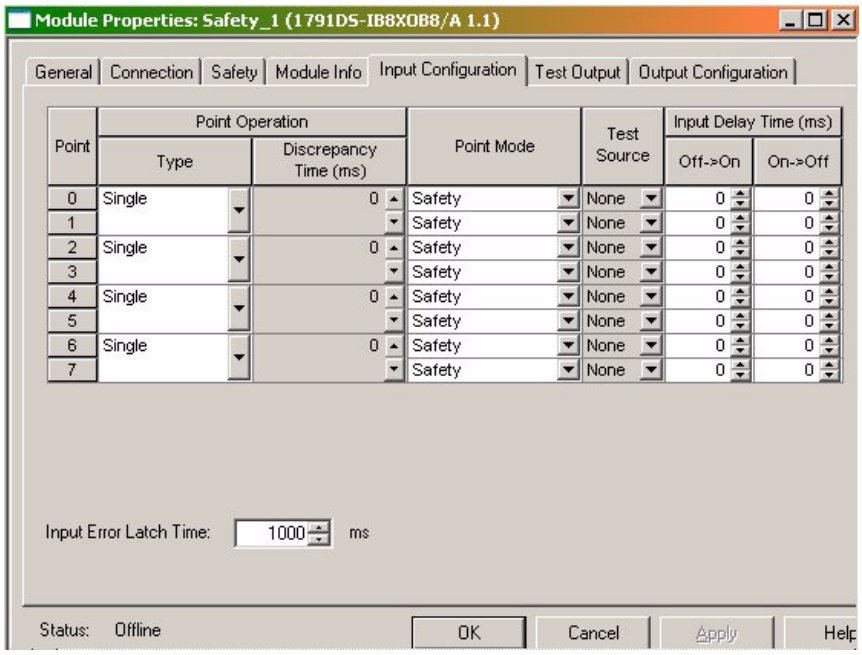
Typical Safety Input Parameters

Parameter Name[1]		Value	Description
x	Input Delay Time Off -> On	0…126 ms (in increments of 6 ms)	Filter time is for OFF to ON transition. Input must be high after input delay has elapsed before it is set logic 1.
x	Input Delay Time On -> Off	0…126 ms (in increments of 6 ms)	Filter time is ON to OFF transition. Input must be low after input delay has elapsed before it is set logic 0.
x	Input Point Mode	Not Used	The input is disabled. It remains logic 0 if 24V is applied to the input terminal.
		Safety Test Pulse	Pulse testing is performed on this input circuit. A test source on the 1791DS module **must** be used as the 24V source for this circuit. The test source is configured using the test source pulldown. The pulse test will detect shorts to 24V and channel-to-channel shorts to other inputs.
		Safety	A safety input is connected but there is no requirement for the 1791DS module to perform a pulse test on this circuit. An example is a safety device that performs its own pulse tests on the input wires, such as a light curtain.
		Standard	A standard device, such as a reset switch, is connected.
x	Safety Input Test Source	None	If pulse testing is being performed on an input point, then the test source that is sourcing the 24V for the input circuit must be selected. If the incorrect test source is entered, the result is pulse test failures on that input circuit.
		Test Output 0	
		Test Output 1	
		Test Output 2	
		Test Output 3	
		Test Output 4…7[2]	
x	Input Point Operation Type	Single Channel	Inputs are treated as single channel.
		Dual-channel Equivalent	Inputs are treated as a dual-channel pair. The channels must match (be equal) within the discrepancy time or a fault is generated.
		Dual-channel Complementary	Inputs are treated as a dual-channel pair. The channels must disagree (be opposite) within the discrepancy time or a fault is generated.
x	Safety Input Error Latch Time	0…65,530 ms (in increments of 10 ms)	Default is 1000 ms. The purpose for latching input errors is to make sure that intermittent faults that may only exist for a few milliseconds are latched long enough to be read by the controller. The amount of time to latch the errors is based on the RPI, the safety task watchdog, and other application-specific variables.

(1) Parameters directly related to safety are marked with an X in the left column.

(2) There are eight test outputs on 1791DS-IB8XOBV4 modules.

Follow this procedure to complete entries from the Input Configuration Dialog that you see when, from the top of the Module Properties dialog, you click Input Configuration.



1. For Point Operation, for Type, select one of these and a value for Discrepancy Time if set to Equivalent or Complementary:

   Single
   Inputs are treated as single channels. Note that in many cases, dual-channel safety inputs are configured as two individual single channels. This does not affect pulse testing because it is handled on an individual channel basis.

   Equivalent(1)
   Inputs are treated as a dual-channel pair. The channels must match within the discrepancy time or an error is generated.

   Complementary(1)
   Inputs are treated as a dual-channel pair. They must be in opposite states within the discrepancy time or an error is generated.

(1) Be aware that configuring discrepancy time on safety I/O modules masks input inconsistent faults from the safety controller.

2. For Point Mode, select one of these for each point, referring to the Safety Input Parameters table for additional information:

   Not Used - Safety input channel is disabled

   Safety Pulse Test - Safety input is configured for pulse test operation

   Safety - Safety input is used with a safety field device

   Standard - Safety input has a standard field device wired to it

3. Complete entries, noting the following:

   For each safety input on the module, you can define if the input will be pulse tested. If the inputs will be pulse tested, select which test source to use. Test sources, such as 0…3, correlate to the standard outputs, such as 0…3, on the module. Test sources, such as 0…7, correlate to standard outputs, such as 0…7, on 1791DS-IB8XOBV4 modules.

   Off -> On and On -> Off delay times can be configured per channel with each channel specifically tuned to match the characteristics of the field device for maximum performance.

   Input Error Latch Time is the time the module holds an error to make sure the controller can detect it. This provides you more reliable diagnostics and enhances the chances that a nuisance error is detected.

4. Click OK at the bottom of the dialog or a tab at the top of the dialog.

Work with Test Output Configuration Dialog

Read this for information about how to work with the Test Output Configuration dialog, referring to the table that provides information on configuring test outputs.

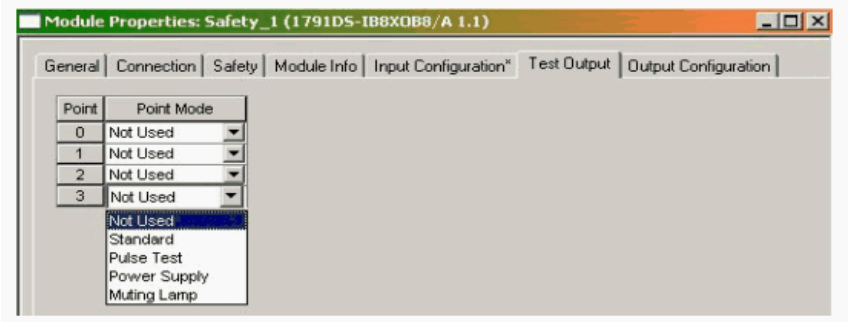
Test Output Parameters

Parameter Name[1]		Value	Description	Default
x	Test Output Mode	Not Used	The standard output is disabled.	Not Used
		Standard	The output point is enabled for use by the GuardLogix controller.	
		Pulse Test	The test output is being used as a pulse test source.	
		Power Supply	A constant 24V is placed on the output terminal. It can be used to provide power to a field device.	
		Muting Lamp Output (Terminal T3/T7 only)	An indicator lamp is connected to the output. When this lamp is energized, a burned-out bulb, broken wire, or short to GND error condition can be detected. Typically, the lamp is an indicator used in light curtain applications.	
	Test Output[2] Fault Action	Clear OFF	If communication to the module times out, test outputs can either go to the OFF state or hold last state.	Clear OFF
		Hold last state		

[1] Parameters directly related to safety are marked with an X in the left column.

[2] Can only be read/write via explicit messaging.

Complete entries on the Test Output dialog, referring to the figure.



Work with the Output Configuration Dialog

Read this for a procedure on how to configure safety outputs by using the information in the table and completing the entries referring to the figure.

Safety Output Parameters

	Parameter Name[1]	Value	Description	Default
x	Point Operation Type	Single	The output is treated as a single channel.	Dual-channel
		Dual	The 1791DS module treats the outputs as a pair. It always sets them HI to LO as a matched pair. Safety logic must set both of these outputs ON or OFF at the same time or the module will declare a channel fault.	
x	Point Mode	Not Used	The output is disabled.	Not Used
		Safety	The output point is enabled, and it does not perform a pulse test on the output.	
		Safety Pulse Test	The output point is enabled and performs a pulse test on the output. When the output is energized, the output pulses LO briefly. The pulse test detects if 24V remains on the output terminal during this LO pulse due to a short to 24V or if the output is shorted to another output terminal.	
x	Output Error Latch Time	0…65,530 ms (in increments of 10 ms)	The purpose for latching output errors is to make sure that intermittent faults that may only exist for a few milliseconds are latched long enough to be read by the controller. The amount of time to latch the errors will be based on the RPI, the safety task watchdog, and other application-specific variables.	1000 ms

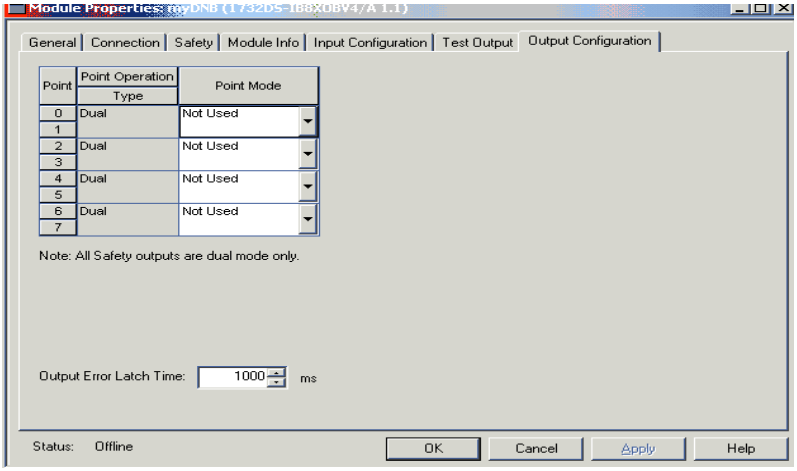
(1) Parameters directly related to safety are marked with an X in the left column.

Follow this procedure to complete entries from the Output Configuration dialog.

1. For Point Operation, select Single or Dual, noting the following if you click Dual:

   The 1791DS module always sets the high or low as a pair.

   You must always match the two ouputs as a pair in software as well.



2. For Point Mode, select Not Used, Safety, or Safety Pulse Test, referring to the Safety Input Parameters table for additional information.

3. Select a value for Output Error Latch Time.

4. Click Apply from the bottom of the dialog.

Save Module Configuration

We recommend that after a module is configured you save your work.

After downloading the program, if the MS and NS LED indicators on the 1791DS module are not both solid green, this may be due to loss of ownership. The ownership is based on the following:

- 1791DS DeviceNet node number
- 1791DS safety network number
- GuardLogix slot number
- GuardLogix safety network number

If any of these change, the connection between the GuardLogix module and the 1791DS module is lost, and the yellow yield in the RSLogix 5000 tree appears. Reset ownership to reestablish the connection using this procedure.

1. From within RSLogix 5000 software, open the safety I/O module properties.
2. Click the Safety tab.
3. From the dialog, click Reset ownership.

Status Data Supported by Each Module

See Appendix D, Configuration Reference Information, for the tables that show the I/O data supported by each module. Refer to I/O Assembly Data for data arrangements.

For I/O data, safety connections for up to four items, including one output, can be allocated for the master unit, and standard connections for up to two items can be allocated for the master unit (scanner).

Configure Modules in RSNetWorx for DeviceNet Software

What This Chapter Contains

This chapter provides information about how to configure Guard I/O modules by using RSNetWorx for DeviceNet software and a SmartGuard controller. Refer to the corresponding software help files for network-configurator operating procedures.

This chapter covers how to configure a SmartGuard controller and Guard I/O module by using Universal Serial Bus (USB) connectivity. For related information, see the appendix that contains sample SmartGuard application code.

Configure a SmartGuard Controller

Use this procedure to configure a SmartGuard controller and Guard I/O module by using Universal Serial Bus (USB) connectivity.

1. Be sure you have these required items:

   RSNetWorx for DeviceNet software, version 8.0 or later

   RSLinx software, version 2.51 or later

   SmartGuard USB driver

   Personal computer with Microsoft Windows 2000, Microsoft Windows 2000 Terminal Server, or Microsoft Windows XP

2. Load the SmartGuard USB driver onto your computer, noting the folder location, as you need to browse to it later.

3. Attach a USB cable between the SmartGuard 600 controller and your computer.

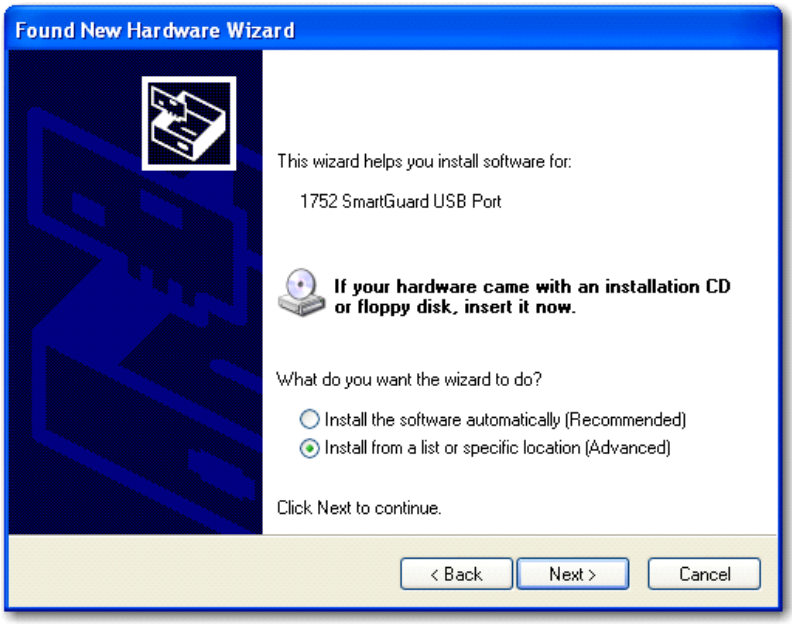
   The Found New Hardware Wizard dialog appears.

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
Windows will search for current and updated software by looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission).
Read our privacy policy
Can Windows connect to Windows Update to search for software?
Yes, this time only
Yes, now and every time I connect a device
No, not this time
Click Next to continue.
< Back
Next >
Cancel

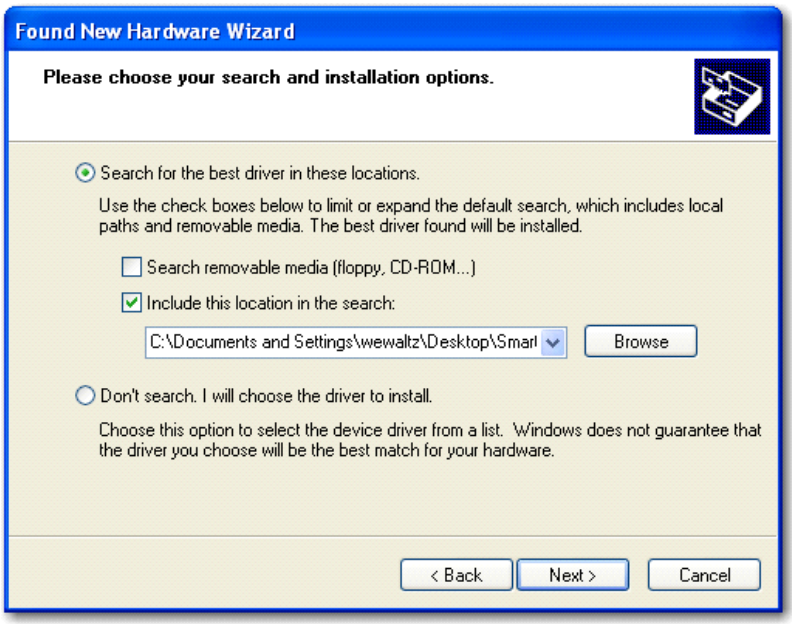
4. From the Found New Hardware Wizard dialog, click Yes, this time only and Next.

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
Windows will search for current and updated software by looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission).
Read our privacy policy
Can Windows connect to Windows Update to search for software?
Yes, this time only
Yes, now and every time I connect a device
No, not this time
Click Next to continue.
< Back
Next >
Cancel

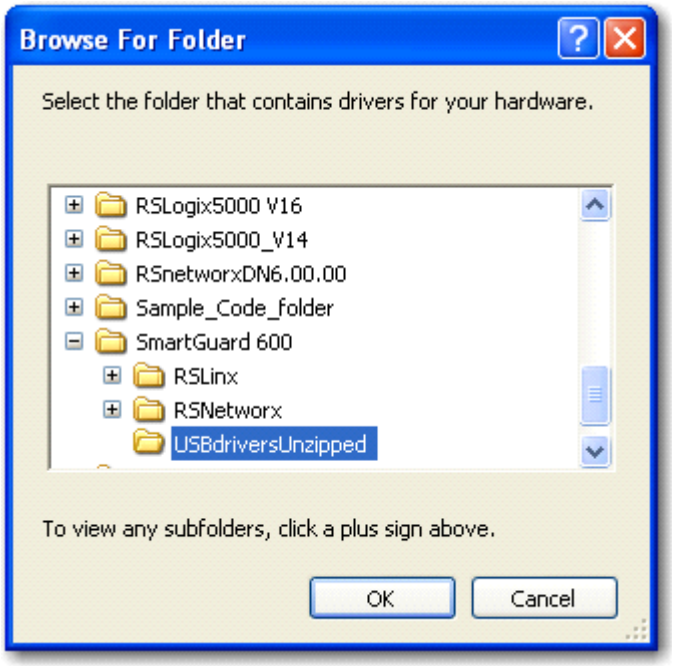
5. From the Found New Hardware Wizard dialog that appears, click Install from a list or specific location (Advanced) and Next.


Found New Hardware Wizard
This wizard helps you install software for:
1752 SmartGuard USB Port
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

6. From the Found New Hardware Wizard dialog that appears, click Browse.

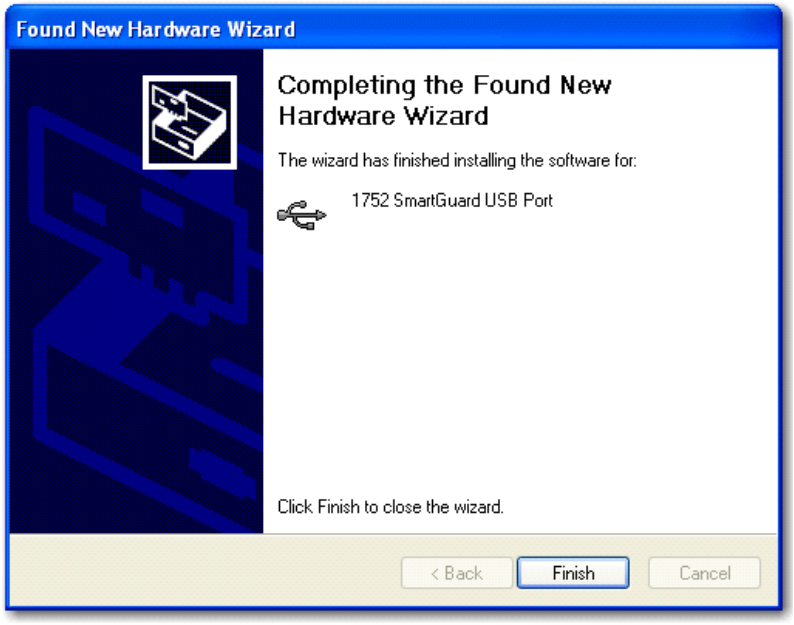

Found New Hardware Wizard
Please choose your search and installation options.
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM...)
Include this location in the search:
C:\Documents and Settings\wewaltz\Desktop\Smarl
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel

7. From the Browse For Folder dialog, browse to the folder where the SmartGuard USB drivers were placed.



8. From the Browse For Folder dialog, click OK.

9. From the Found New Hardware Wizard, click Next, noting that if loading of the SmartGuard drivers is successful, you see this dialog.


Found New Hardware Wizard
Completing the Found New Hardware Wizard
The wizard has finished installing the software for:
1752 SmartGuard USB Port
Click Finish to close the wizard.
< Back
Finish
Cancel

10. From the Found New Hardware Wizard dialog, click Finish.

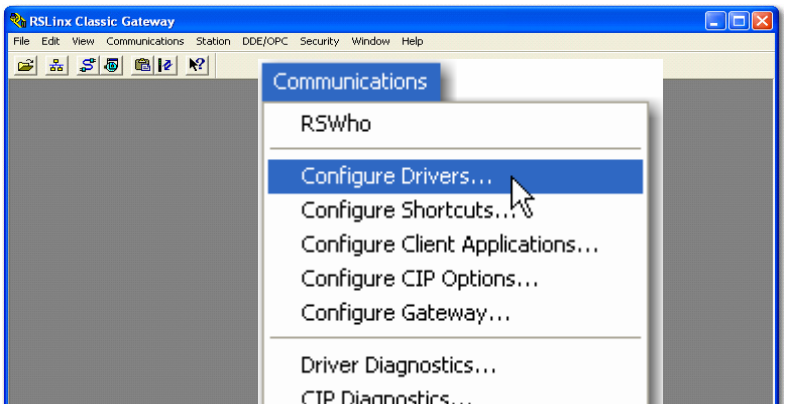
11. Open RSLinx software, version 2.51 or later, and proceed with configuring the SmartGuard USB driver.

Configure the SmartGuard USB Driver

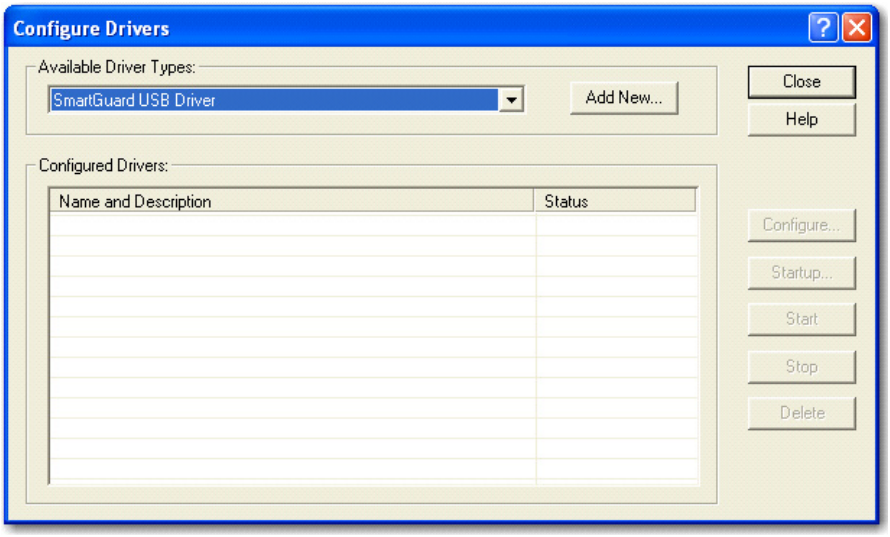
Use this procedure to configure the SmartGuard USB driver.

1. Open RSLinx software, version 2.51 or later.

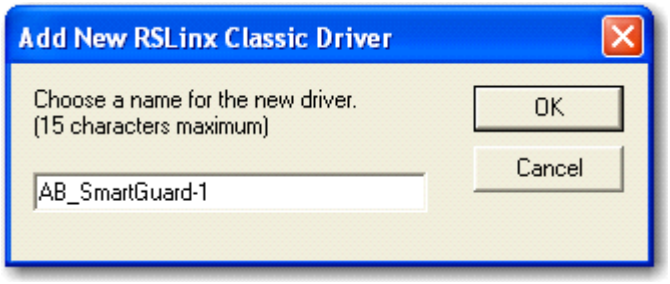
2. From the RSLinx Classic Gateway dialog, click Communications and Configure Drivers to see the Configure Drivers dialog.



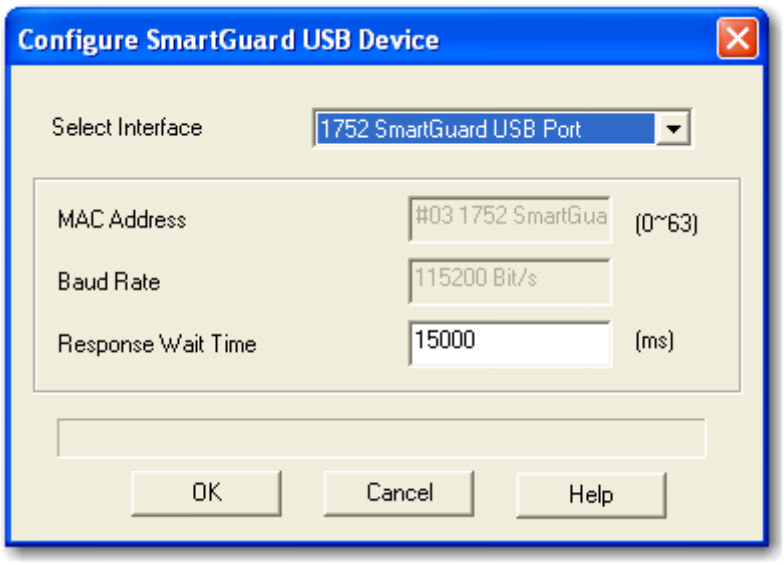
3. From Configure Drivers dialog, click SmartGuard USB Driver.



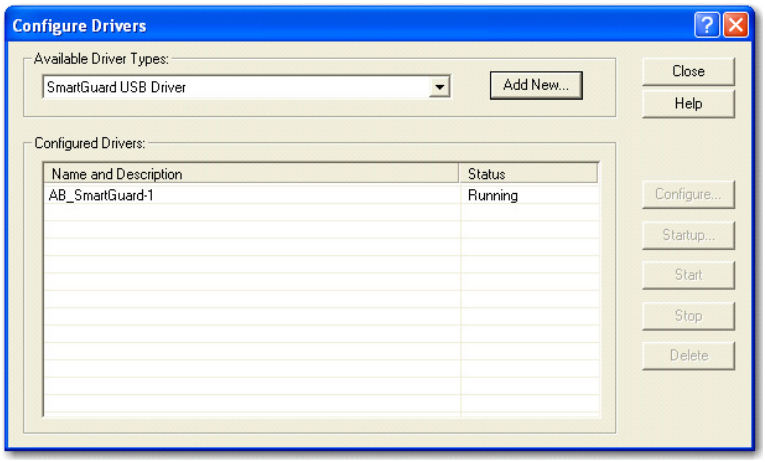
4. From the Configure Drivers dialog, click Add New.



5. From the Add New RSLinx Classic Driver dialog, click OK to see the Configure SmartGuard USB Device dialog.



6. From the Configure SmartGuard USB Device dialog, click 1752 SmartGuard USB Port, noting that the MAC address and Baud Rate fill in and the OK button highlights if the SmartGuard controller is connected properly on the USB link.



7. From the Configure SmartGuard USB Device dialog, click OK to see the Configure Drivers dialog, noting that the SmartGuard driver should be running.

8. From the Configure Drivers dialog, click close.

9. Follow the procedure for working with RSNetworx for DeviceNet software.

Work with RSNetworx for DeviceNet Software

Use this procedure to work with RSNetworx for DeviceNet software.

1. Before you begin to design a project with RSNetworx for DeviceNet software, follow these procedures.

   a. Load the proper electronic data sheet (EDS) files using the EDS Hardware Installation Tool. For all products, as needed, for your project, if using the following for the first time, find the EDS files at http://www.rockwellautomation.com/:

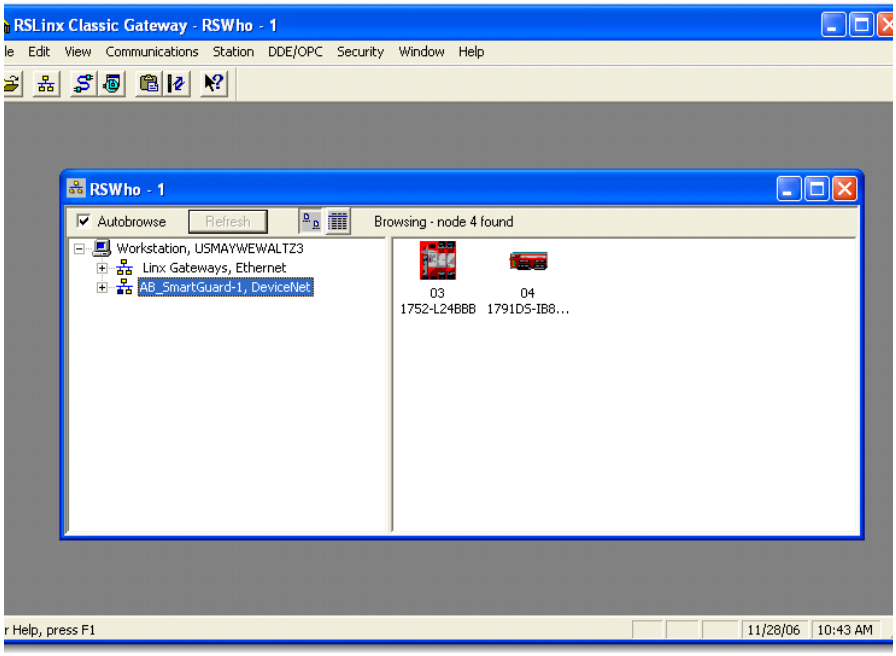
      1791DS Guard I/O modules

      1732DS Guard I/O modules

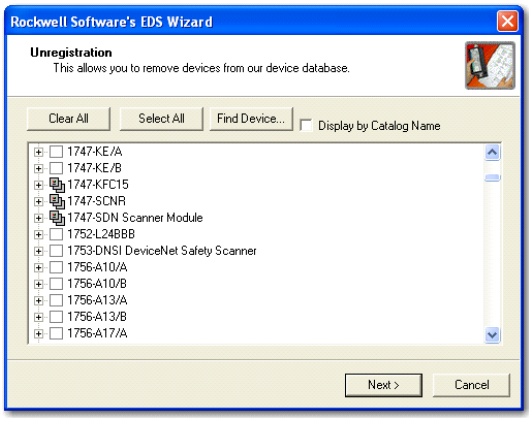
      1752 SmartGuard controller

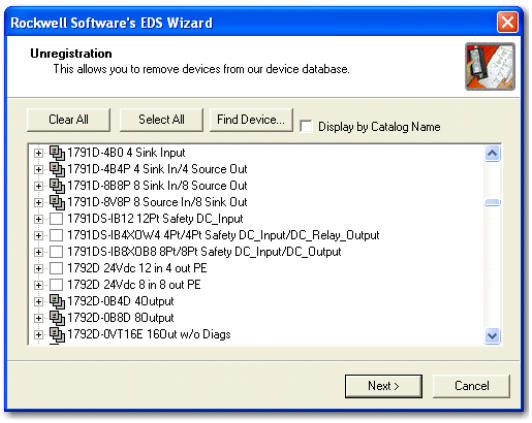
   b. From RSLinx software, open RSWho and select the SmartGuard driver, noting that it browses the DeviceNet network connected to the SmartGuard.

In this case, we have a single 1791DS safety I/O module connected to the SmartGuard.



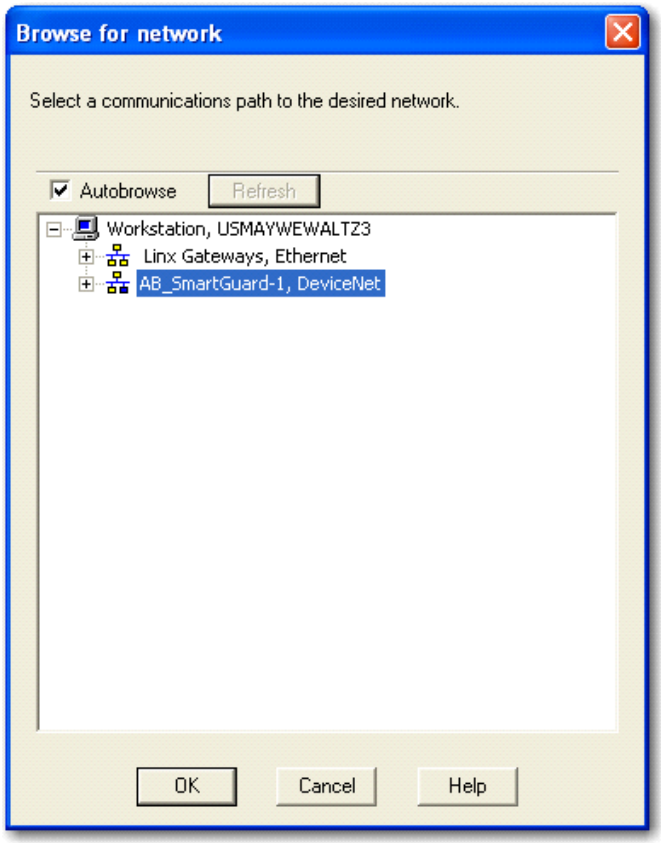
Note that images of the 1791DS module and SmartGuard (1752) controller show up when you previously load the proper EDS files using the EDS Hardware Installation Tool.




Rockwell Software's EDS Wizard
Unregistration
This allows you to remove devices from our device database.
Clear All
Select All
Find Device...
Display by Catalog Name
1791D-4B0 4 Sink Input
1791D-4B4P 4 Sink In/4 Source Out
1791D-8B8P 8 Sink In/8 Source Out
1791D-8V8P 8 Source In/8 Sink Out
1791DS-IB12 12Pt Safety DC_Input
1791DS-IB4XOW4 4Pt/4Pt Safety DC_Input/DC_Relay_Output
1791DS-IB8XOB8 8Pt/8Pt Safety DC_Input/DC_Output
1792D 24Vdc 12 in 4 out PE
1792D 24Vdc 8 in 8 out PE
1792D-0B4D 4Output
1792D-0B8D 8Output
1792D-0VT16E 16Out w/o Diags
Next >
Cancel

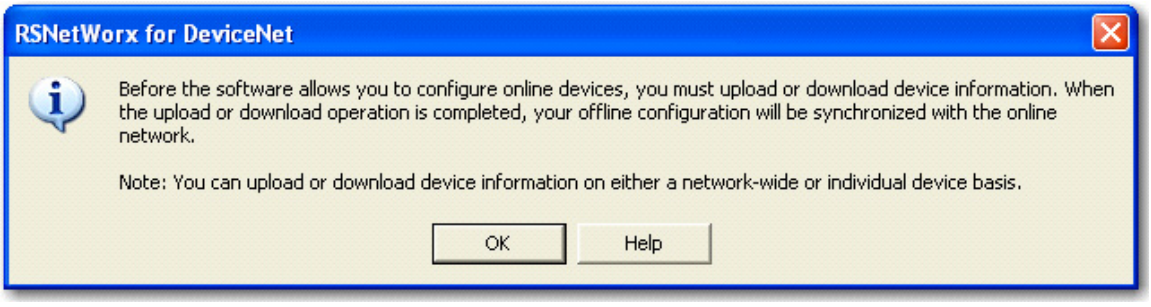
Note that if RSLinx software sees the nodes on the DeviceNet network, RSNetworx sees the nodes.

2. Open RSNetworx for DeviceNet software, create a new project, and click the Online icon to see the Browse for network dialog.



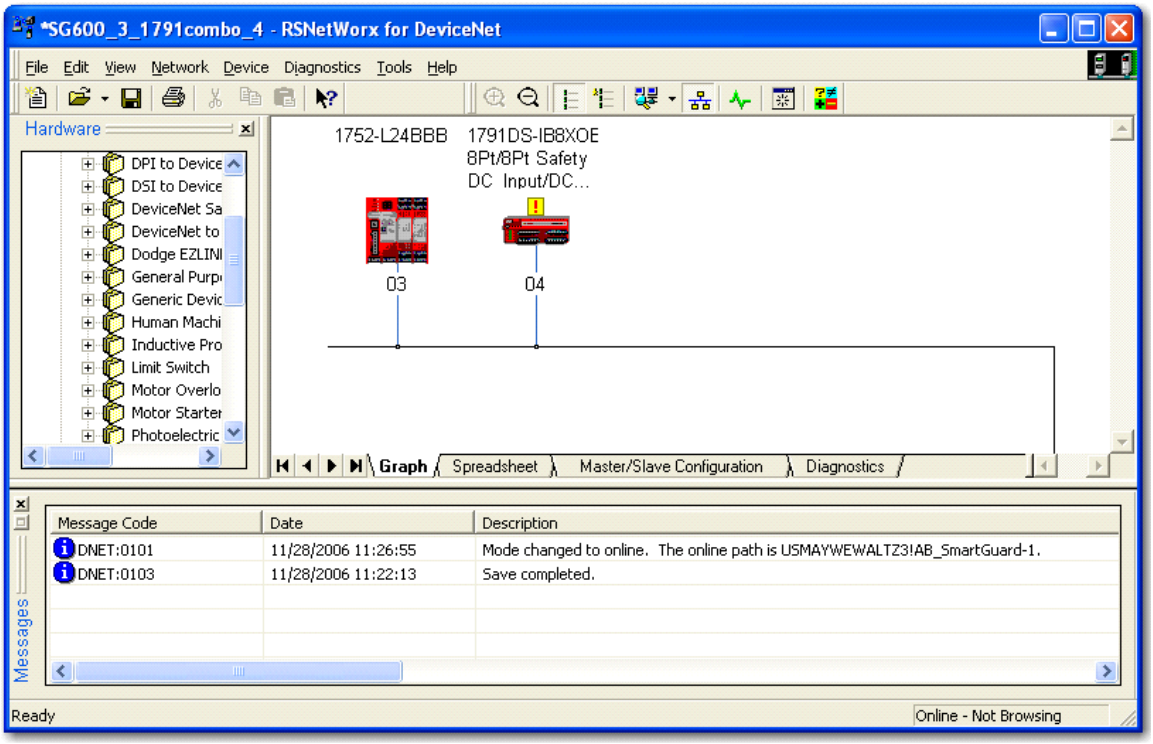
3. From the Browse for network dialog, click the SmartGuard driver and OK.

4. In RSNetworx for DeviceNet software, if you have created a new project, this RSNetWorx for DeviceNet dialog appears.

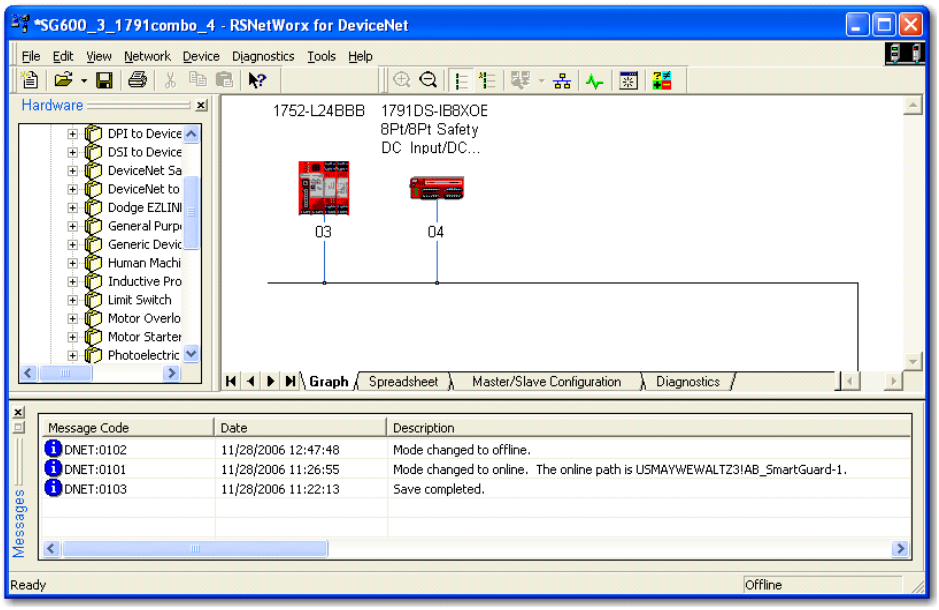

RSNetWorx for DeviceNet
Before the software allows you to configure online devices, you must upload or download device information. When the upload or download operation is completed, your offline configuration will be synchronized with the online network.
Note: You can upload or download device information on either a network-wide or individual device basis.
OK
Help

5. From the RSNetWorx for DeviceNet message, click OK.

   Note that RSNetworx for DeviceNet software finds both the SmartGuard and 1791DS module on the DeviceNet network. Notice that the exclamation mark represents an issue with the safety network number of the 1791DS module.



6. Click the online icon again to put RSNetworx for DeviceNet software in Offline mode.

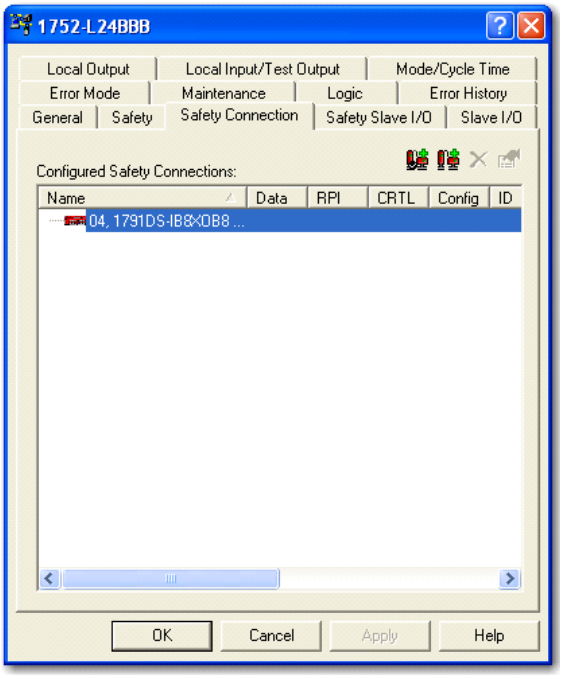


7. From the RSNetworx for DeviceNet dialog, right-click the SmartGuard icon, select Properties, and follow the procedure for setting up the SmartGuard controller.

Set Up the SmartGuard Controller

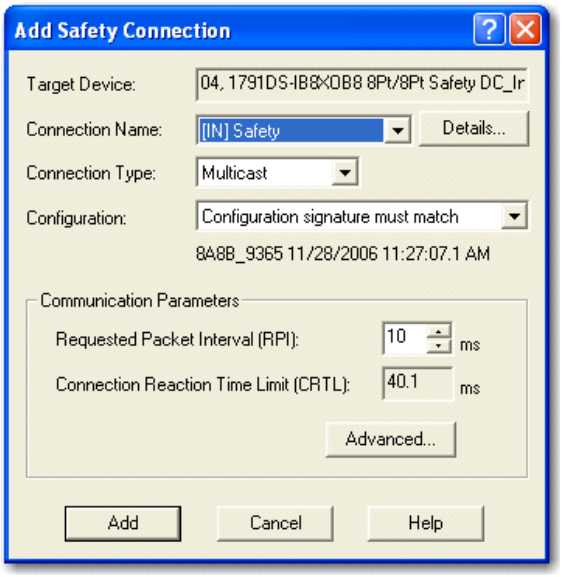
Use this procedure to set up the SmartGuard controller.

1. From the RSNetworx for DeviceNet dialog, right-click SmartGuard and Properties to see the 1752-L24BBB dialog.



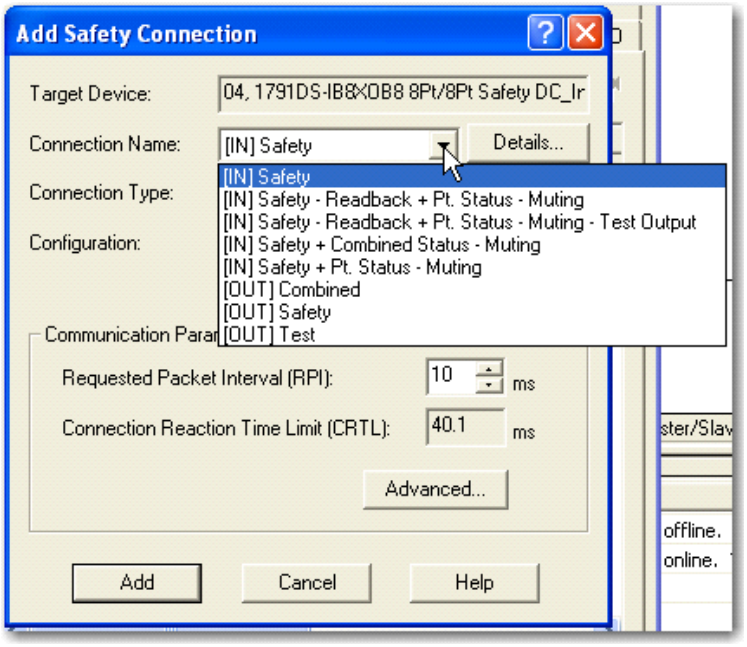
2. From the top of the 1752-L24BBB dialog, click Safety Connection to see a dialog that contains a list of all safety I/O modules currently in your project.

3. Right-click the I/O module and select Add Connection to see the Add Safety Connection dialog.



Note that individual safety connections for both the inputs and outputs can be added and the SmartGuard 600 controller can have up to 32 connections.

4. To see possible connections, if desired, from the Add Safety Connection dialog, click Connection Name.



Note these input and output connection options:

Input connection options

Readback is status of 24V on the output terminals.

Pt (point) status provides individual status for each input and output point.

Combined status is one bit for all inputs, one bit for all safety outputs.

Muting status and Test Output status are available.

The more status read, the larger the packet size.

Output connection options

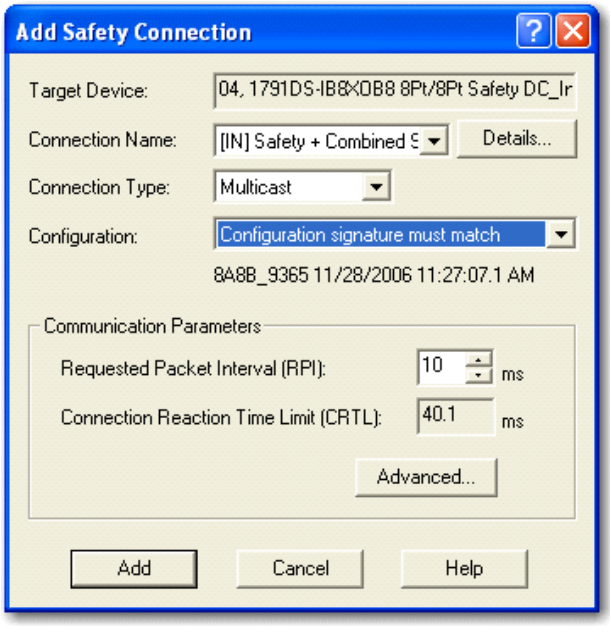
Safety provides control of safety outputs, but not test outputs.

Test provides control of test outputs, but not safety outputs.

Combined provides control of both safety and test outputs.

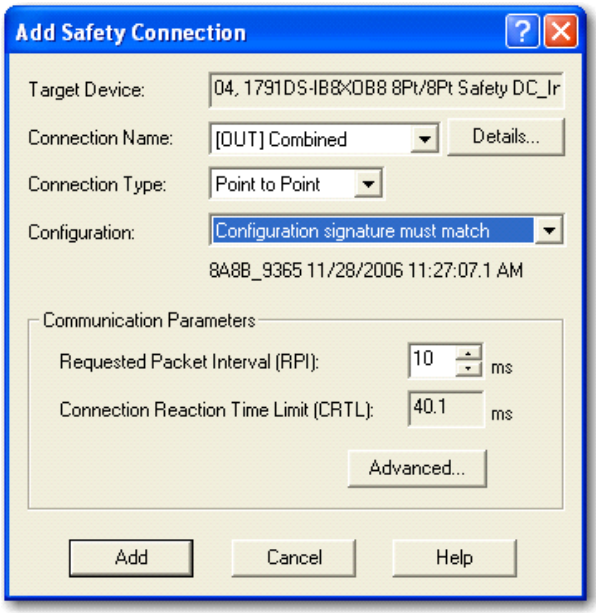
5. From the Add Safety Connection dialog, make selections as shown in the following dialog and click Add, noting that a typical selection is combined status for the input connection.

   This limits the packet size for normal communications. If detailed status is required when a fault occurs, that data can be read explicitly via MSG instructions.

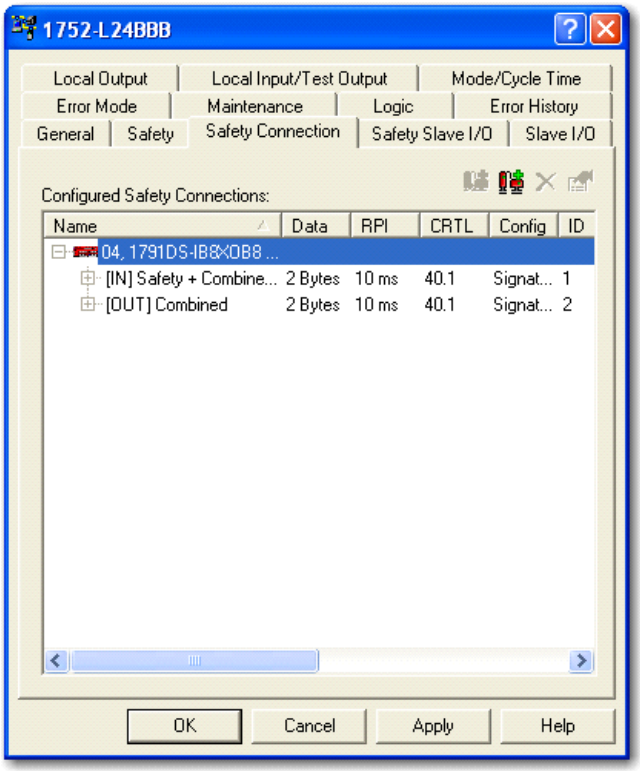


6. Right-click the I/O module and select Add Connection.

7. From the Add Safety Connection dialog, make selections for the output connection, as shown in the following, and click Add.



Note that the connections for a 1791DS- IB8XOB8 module appear as follows, where both connections are 2 bytes. If individual point status was selected, the input connection is 5 bytes.



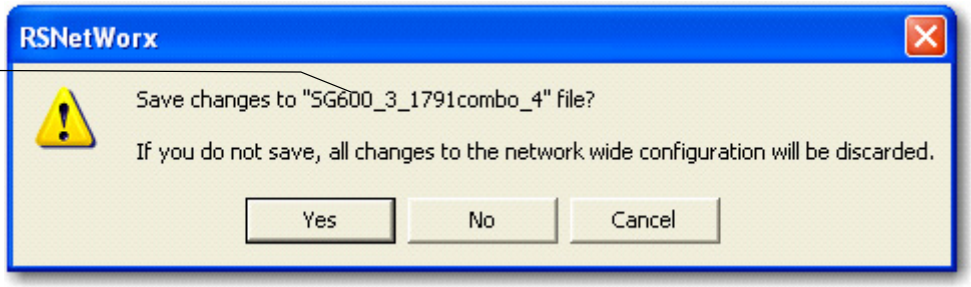
For further details, see the SmartGuard 600 Controllers User Manual, publication 1752-UM001, and SmartGuard 600 Controllers Safety Reference Manual, publication 1752-RM001.

8. From the 1752-L24BBB dialog, click Apply and OK to accept the connection.

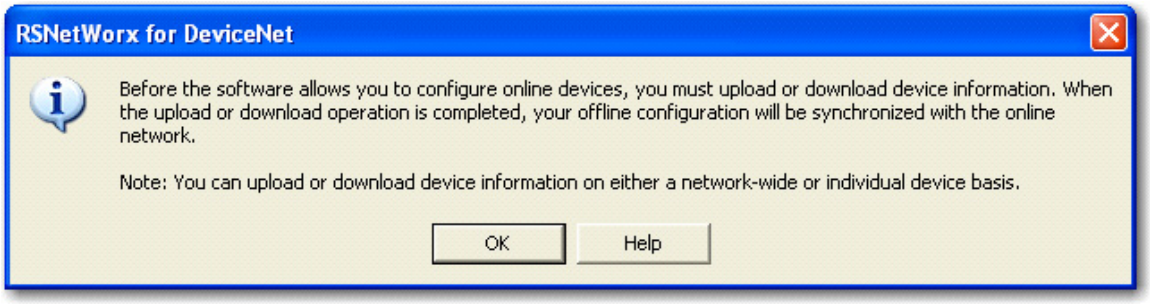
9. Place RSNetworx from DeviceNet software back into Online mode.

   a. If you see this dialog, click yes.

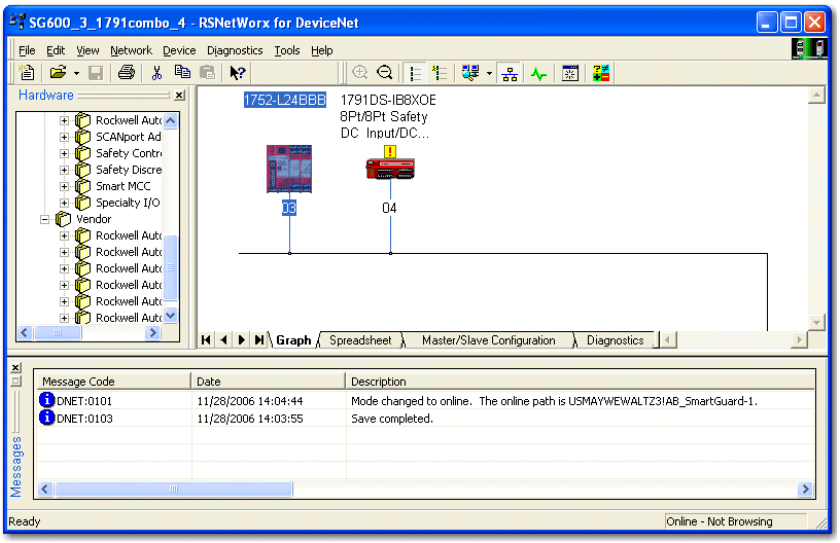
Your Project Name Goes Here


RSNetWorx
Save changes to "SG600_3_1791combo_4" file?
If you do not save, all changes to the network wide configuration will be discarded.
Yes
No
Cancel

   b. From the RSNetworx for DeviceNet dialog that appears, click OK.


RSNetWorx for DeviceNet
Before the software allows you to configure online devices, you must upload or download device information. When the upload or download operation is completed, your offline configuration will be synchronized with the online network.
Note: You can upload or download device information on either a network-wide or individual device basis.
OK
Help

You see the following nodes after the browse.

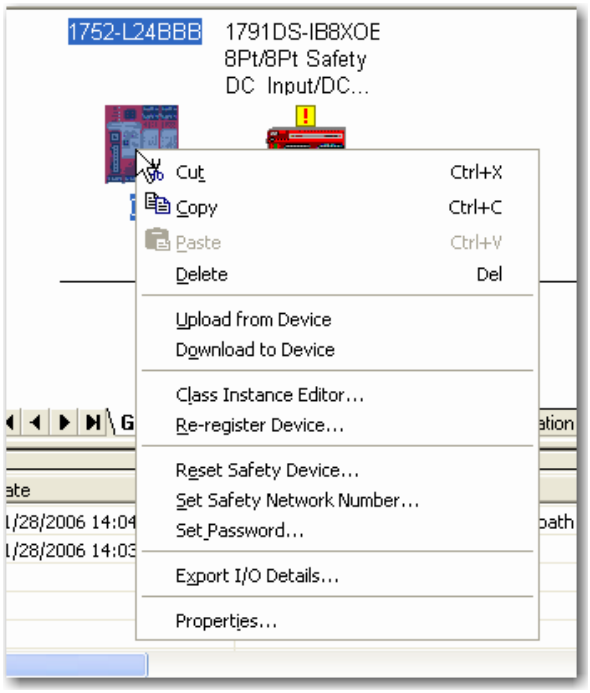


10. Right-click the SmartGuard 600 controller, select Download to Device, and follow the download procedure.

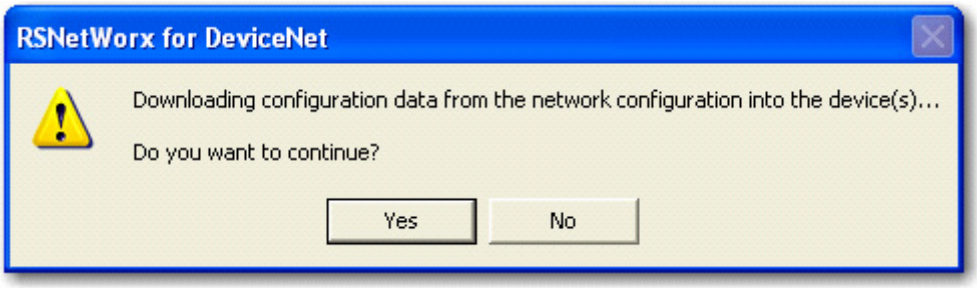
Download to the SmartGuard 600 Controller

Use this procedure to download.

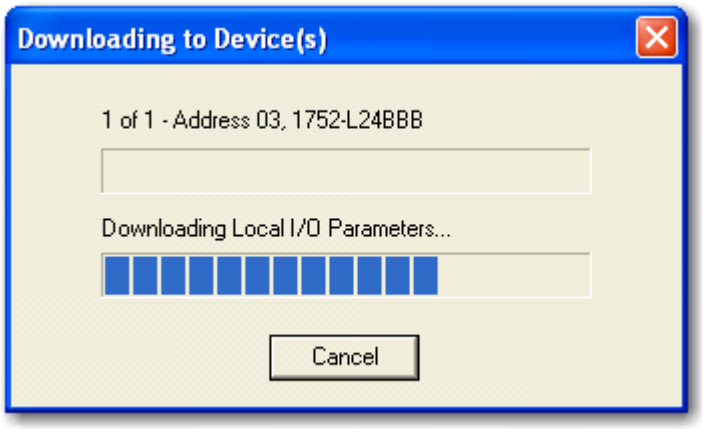
1. Right-click the SmartGuard 600 icon and select Download to Device.



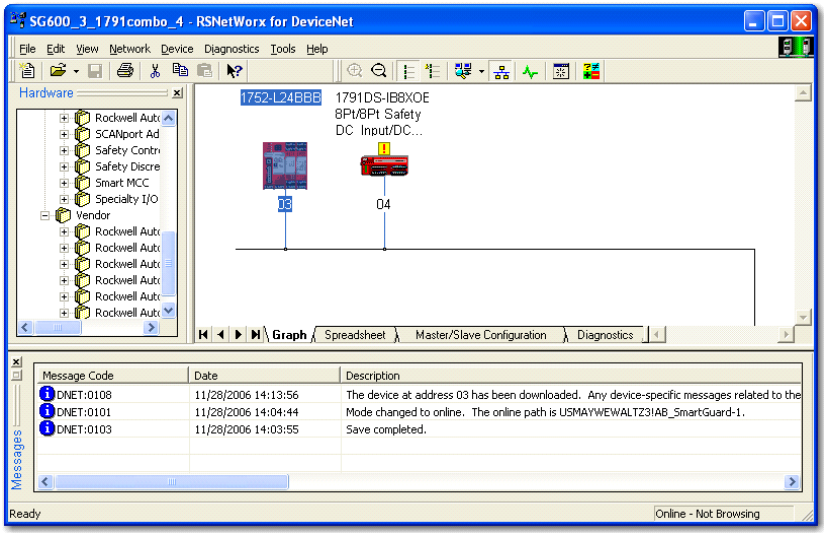
2. From the RSNetWorx for DeviceNet dialog that appears, click Yes.


RSNetWorx for DeviceNet
Downloading configuration data from the network configuration into the device(s)...
Do you want to continue?
Yes
No

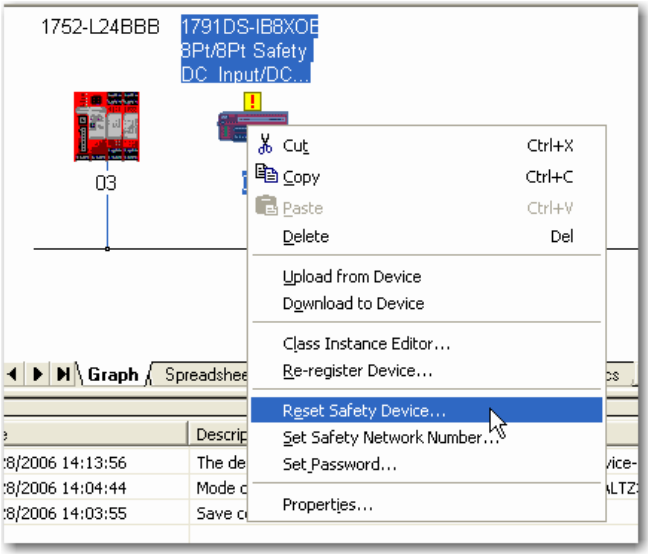
Notice that this dialog appears during the download to the SmartGuard 600.



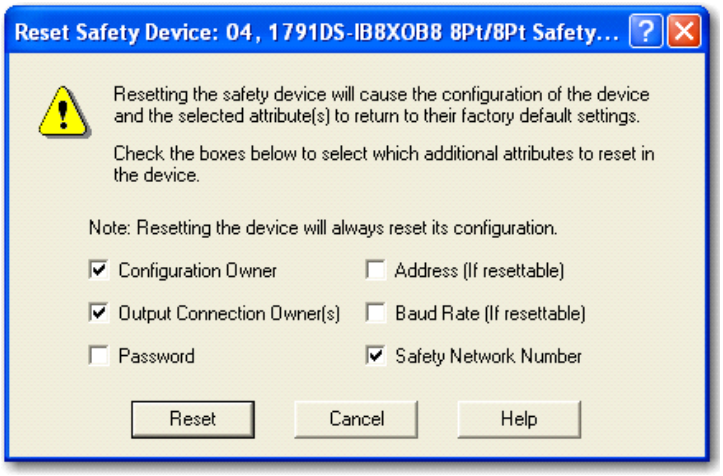
If the download is successful, text appears in the message area, as shown in the following dialog.



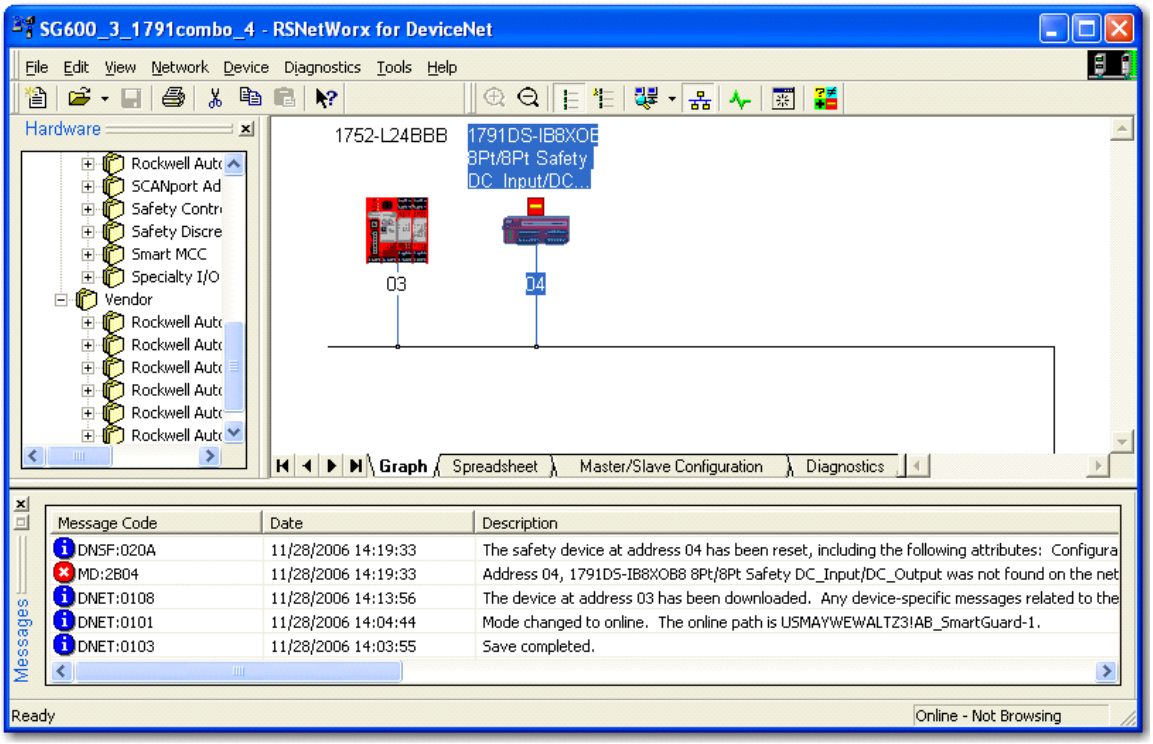
3. Right-click the 1791DS module and select Reset Safety Device.



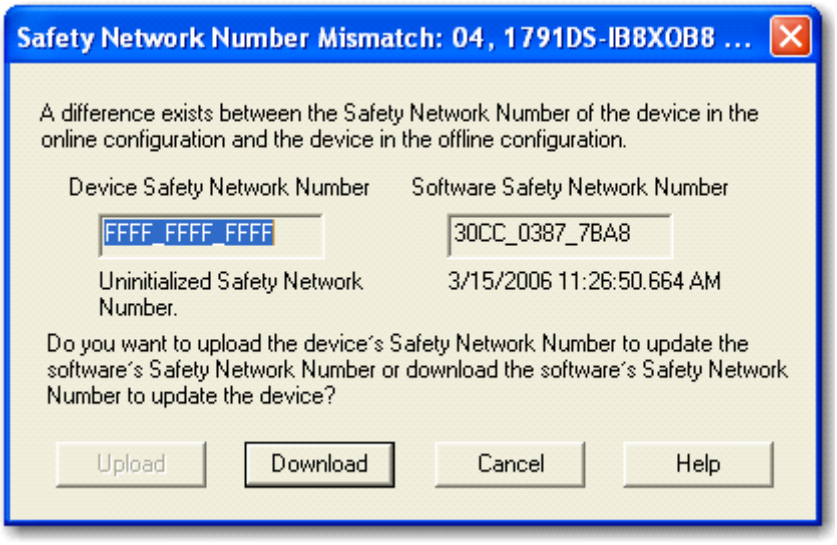
4. From the Reset Safety Device dialog, add a checkmark for Safety Network Number and click Reset, noting that Configuration Owner and Output Connection Owner(s) are already checked.


Reset Safety Device: 04, 1791DS-IB8XOB8 8Pt/8Pt Safety...
Resetting the safety device will cause the configuration of the device and the selected attribute(s) to return to their factory default settings.
Check the boxes below to select which additional attributes to reset in the device.
Note: Resetting the device will always reset its configuration.
Configuration Owner
Address (If resettable)
Output Connection Owner(s)
Baud Rate (If resettable)
Password
Safety Network Number
Reset
Cancel
Help

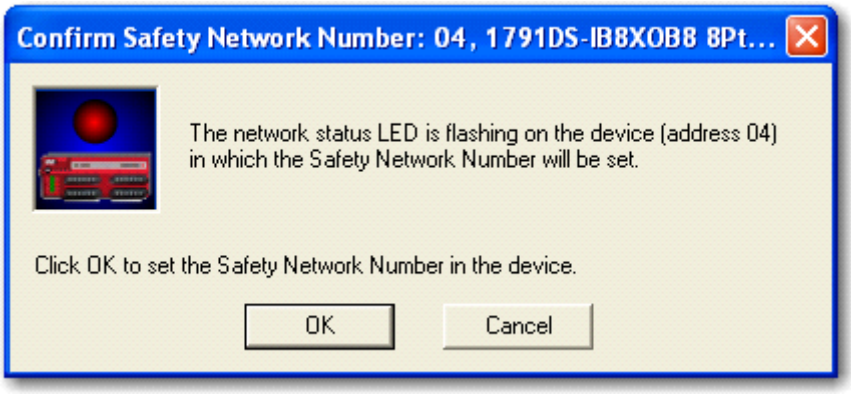
If successfully reset, the following text appears in the message area. Note the exclamation point has changed to a minus sign on the 1791DS module. The minus sign typically means the node is missing; but this is not the case. Disregard the minus sign and continue.


SG600_3_1791combo_4 - RSNetWorx for DeviceNet
File Edit View Network Device Diagnostics Tools Help
Hardware
1752-L24BBB
1791DS-IB8XOE
8Pt/8Pt Safety
DC_Input/DC...
03
04
Graph
Spreadsheet
Master/Slave Configuration
Diagnostics
Message Code
Date
Description
DNSF:020A 11/28/2006 14:19:33 The safety device at address 04 has been reset, including the following attributes: Configura
MD:2B04 11/28/2006 14:19:33 Address 04, 1791DS-IB8XOB8 8Pt/8Pt Safety DC_Input/DC_Output was not found on the net
DNET:0108 11/28/2006 14:13:56 The device at address 03 has been downloaded. Any device-specific messages related to the
DNET:0101 11/28/2006 14:04:44 Mode changed to online. The online path is USMAYWEWALTZ3!AB_SmartGuard-1.
DNET:0103 11/28/2006 14:03:55 Save completed.
Messages
Ready
Online - Not Browsing

5. Right-click the 1791DS module and select Properties to see the Safety Network Number dialog.


Safety Network Number Mismatch: 04, 1791DS-IB8XOB8 ...
A difference exists between the Safety Network Number of the device in the online configuration and the device in the offline configuration.
Device Safety Network Number
Software Safety Network Number
FFFF_FFFF_FFFF
30CC_0387_7BA8
Uninitialized Safety Network Number.
3/15/2006 11:26:50.664 AM
Do you want to upload the device's Safety Network Number to update the software's Safety Network Number or download the software's Safety Network Number to update the device?
Upload
Download
Cancel
Help

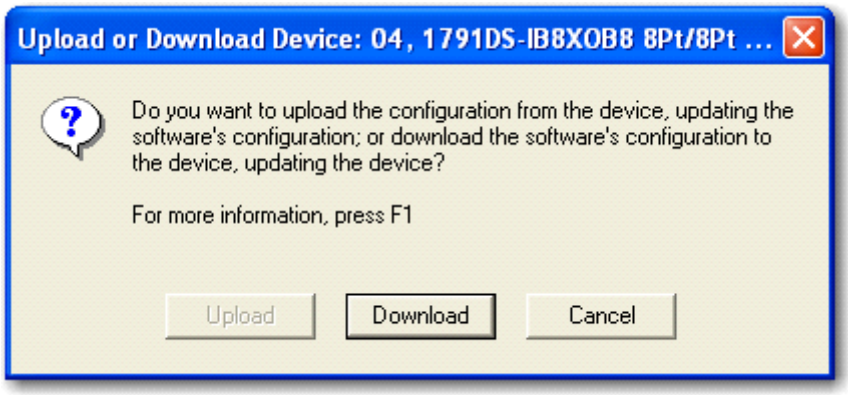
6. From the Safety Network Number dialog, click Download to download the safety network number from the offline project to the 1791DS module.


Confirm Safety Network Number: 04, 1791DS-IB8XOB8 8Pt...
The network status LED is flashing on the device (address 04) in which the Safety Network Number will be set.
Click OK to set the Safety Network Number in the device.
OK
Cancel

7. Verify that the NS LED indicator on the 1791DS module is flashing red/green and from the Confirm Safety Network Number dialog, click OK.

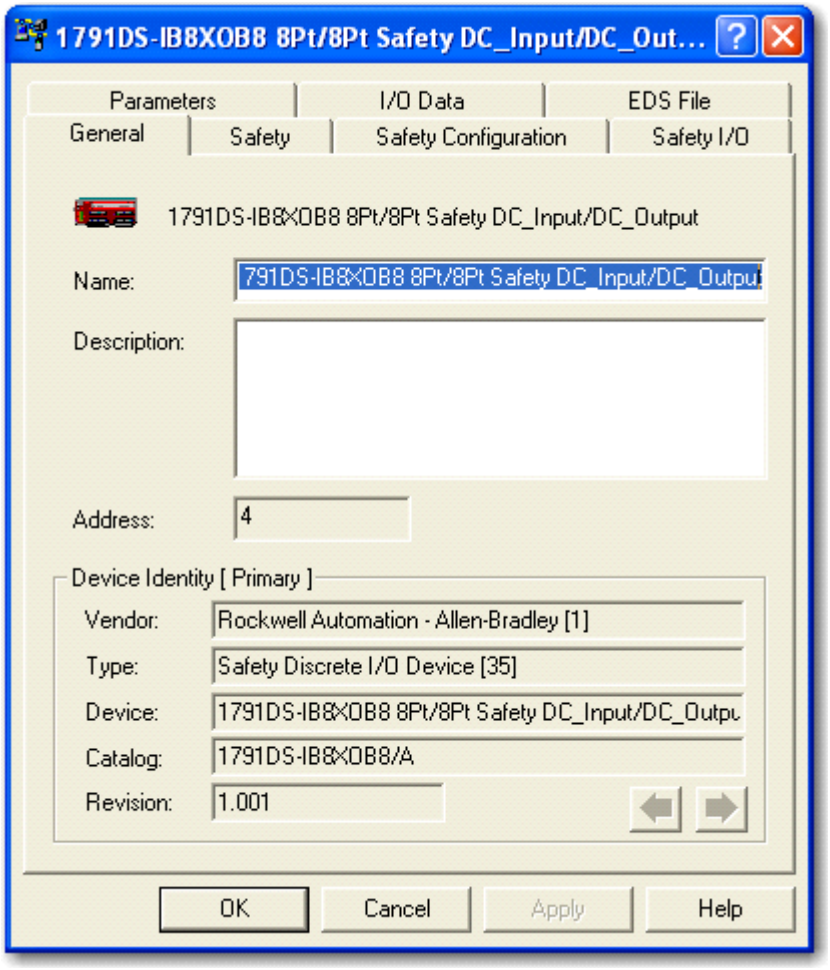
8. If the SNN is set, the RSNetworx for DeviceNet dialog appears.

9. From the RsNetworx for DeviceNet dialog, click OK to see the Upload or Download Device dialog.


Upload or Download Device: 04, 1791DS-IB8XOB8 8Pt/8Pt ...
Do you want to upload the configuration from the device, updating the software's configuration; or download the software's configuration to the device, updating the device?
For more information, press F1
Upload
Download
Cancel

10. From the Upload or Download Device dialog, click Download to download the configuration from RSNetworx for DeviceNet software to the 1791DS module.

11. After the download, from the dialog that appears, click OK.

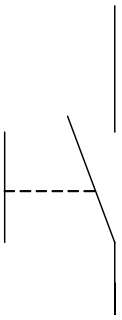
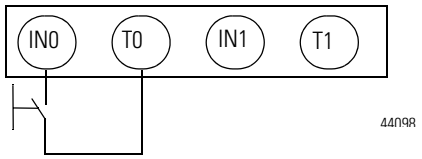
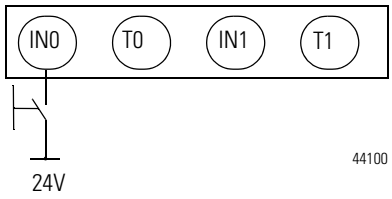


Wiring Examples

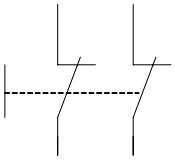
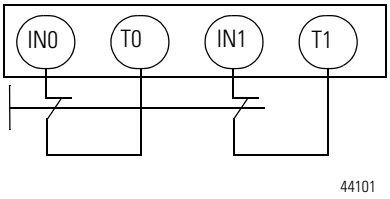
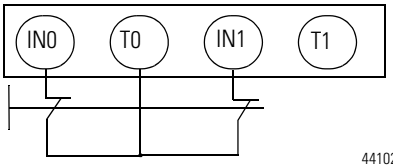
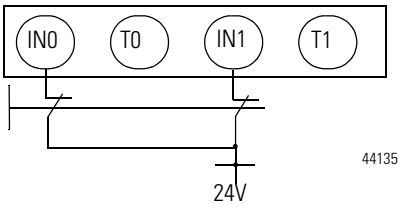
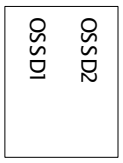
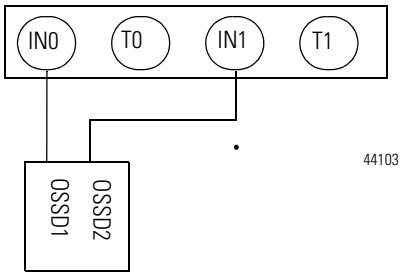
What This Chapter Contains

Read this chapter for information about wiring and safety categories. See the tables that show input device connection methods and their safety categories.

Connected Device and Safety Category

Connected Device	Test Output Configured For Pulse Test	Connection	Schematic Diagram	Safety Category
Reset switch 	No	Connect the switch between IN0 and T0, noting that T0 is configured for 24V power supply. .		-
		Connect the switch between 24V dc and IN0.		-

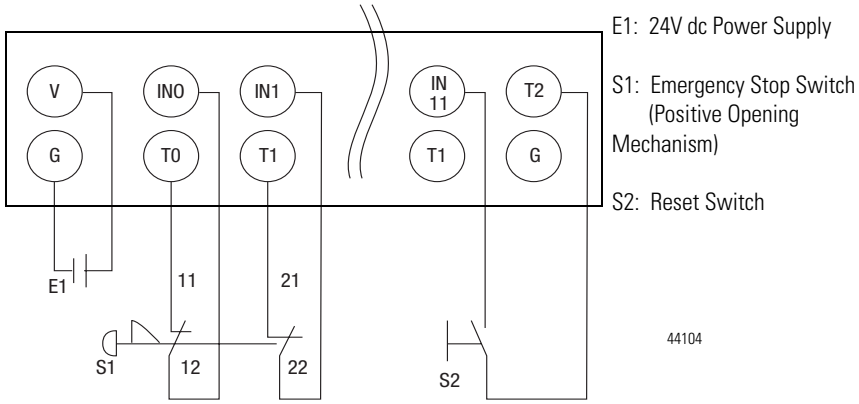
Connected Device and Safety Category

Connected Device	Test Output Configured For Pulse Test	Connection	Schematic Diagram	Safety Category
Emergency stop switch Door monitor 	Yes	Connect the switches between IN0 and T0, and IN1 and T1.		4
	No	Connect the switches between T0 and IN0, IN1, noting that T0 is configured for 24V power supply.		3
		Connect the switches between 24V dc and IN0, IN1.		
Light curtain 	No	Connect the OSSD1 and OSSD2 to IN0 and IN1, respectively.		4

Examples of Wiring

Read this section for examples of wiring by application.

1791DS-IB12 Emergency Stop Switch Dual-channel Inputs with Manual Reset



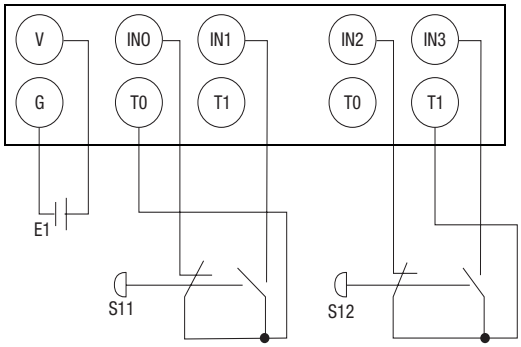
1791DS-IB12 Emergency Stop Switch Dual-channel Inputs with Manual Reset

Controller Configuration	Parameter Name	Value
Safety Input 0	Safety Input 0 Channel Mode	Test Pulse from Test Output
	Safety Input 0 Test Source	Test Output 0
	Dual-channel Safety Input 0/1 Mode	Dual-channel Equivalent
	Dual-channel Safety Input 0/1 Discrepancy Time	100 x 10 ms (application dependent)
Safety Input 1	Safety Input 1 Channel Mode	Test Pulse from Test Output
	Safety Input 1 Test Source	Test Output 1
Safety Input 11	Safety Input 11 Channel Mode	Used as Standard Input
	Safety Input 11 Test Source	Not Used
	Dual-channel Safety Input 10/11 Mode	Single Channel
Test Output 0	Test Output 0 Mode	Pulse Test Output
Test Output 1	Test Output 1 Mode	Pulse Test Output
Test Output 2	Test Output 2 Mode	Power Supply Output

This example shows wiring and controller configuration when using the 1791DS-IB12 slave.

If used in combination with the programs in a safety controller, this wiring is Safety Category 4 in accordance with EN 954-1 wiring requirements.

1791DS-IB12 Two-hand Input



E1: 24V dc Power Source

S11, S12: Two-hand Control Switch

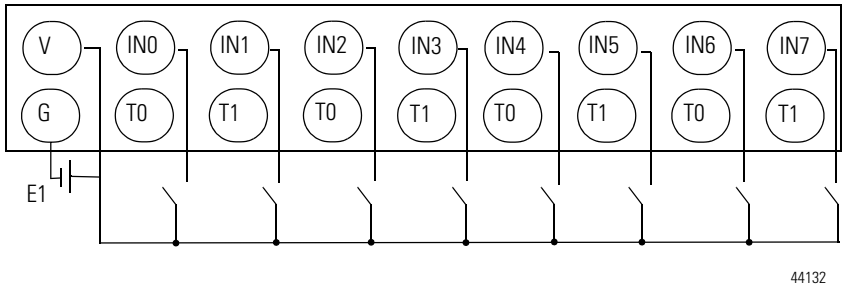
1791DS-IB12 Two-hand Input

Controller Configuration	Parameter Name	Value
Safety Input 0	Safety Input 0 Channel Mode	Test Pulse from Test Output
	Safety Input 0 Test Source	Test Output 0
	Dual-channel Safety Input 0/1 Mode	Dual-channel Complementary
	Dual-channel Safety Input 0/1 Discrepancy Time	100 x 10 ms (application dependent)
Safety Input 1	Safety Input 1 Channel Mode	Test Pulse from Test Output
	Safety Input 1 Test Source	Test Output 0
Safety Input 2	Safety Input 2 Channel Mode	Test Pulse from Test Output
	Safety Input 2 Test Source	Test Output 1
	Dual-channel Safety Input 2/3 Mode	Dual-channel Complementary
	Dual-channel Safety Input 2/3 Discrepancy Time	100 x 10 ms (application dependent)
Safety Input 3	Safety Input 3 Channel Mode	Test Pulse from Test Output
	Safety Input 3 Test Source	Test Output 1
Test Output 0	Test Output 0 Mode	Pulse Test Output
Test Output 1	Test Output 1 Mode	Pulse Test Output

This example shows wiring and controller configuration when using the 1791DS-IB12 module.

If used in combination with the programs of a safety controller, the wiring is Category 4 in accordance with EN954-1 wiring requirements.

1791DS-IB12 User-mode Switch Input

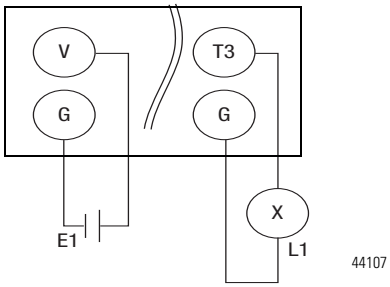


1791DS-IB12 User-mode Switch Input

Controller Configuration	Parameter Name	Value
Safety Input 0	Safety Input 0 Channel Mode	Safety Input
	Safety Input 0 Test Source	None
	Dual-channel Safety Input 0/1 Mode	Single Channel
Safety Input 1	Safety Input 1 Channel Mode	Safety Input
	Safety Input 1 Test Source	None
Safety Input 2	Safety Input 2 Channel Mode	Safety Input
	Safety Input 2 Test Source	None
	Dual-channel Safety Input 2/3 Mode	Single Channel
Safety Input 3	Safety Input 3 Channel Mode	Safety Input
	Safety Input 3 Test Source	None
Safety Input 4	Safety Input 4 Channel Mode	Safety Input
	Safety Input 4 Test Source	None
	Dual-channel Safety Input 4/5 Mode	Single Channel
Safety Input 5	Safety Input 5 Channel Mode	Safety Input
	Safety Input 5 Test Source	None
Safety Input 6	Safety Input 6 Channel Mode	Safety Input
	Safety Input 6 Test Source	None
	Dual-channel Safety Input 6/7 Mode	Single Channel
Safety Input 7	Safety Input 7 Channel Mode	Safety Input
	Safety Input 7 Test Source	None

This example shows wiring and configuration when using the 1791DS-IB12 module.

1791DS-12 Muting Lamp Output



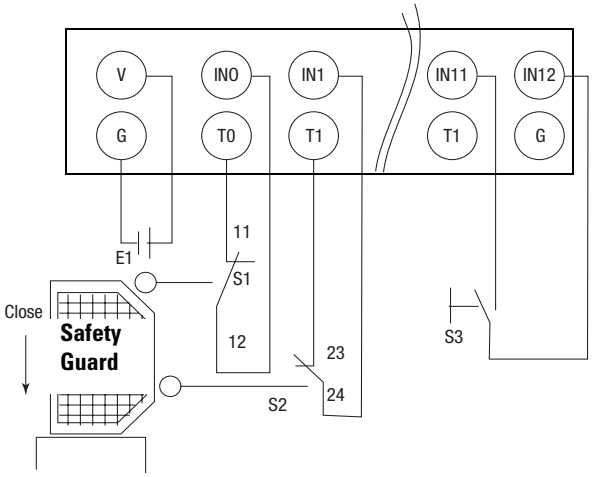
E1: 24V dc Power Source
L1: External Muting Lamp

This example shows wiring and configuration when using the 1791DS-IB 12 module.

1791DS-12 Muting Lamp Output

Controller Configuration	Parameter Name	Value
Test Output 3	Test Output 3 Mode	Muting Lamp Output

1791DS-IB12 Limit Switch Dual-channel Inputs and a Manual Reset



E1: 24V dc Power Supply

S1: Safety Limit Switch (Positive Opening Mechanism)

S2: Limit Switch

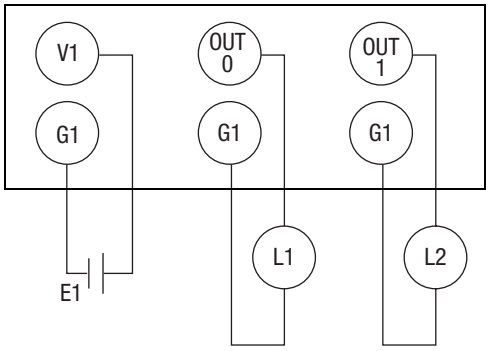
S3: Reset Switch

1791DS-IB12 Limit Switch Dual-channel Inputs and a Manual Reset

Controller Configuration	Parameter Name	Value
Safety Input 0	Safety Input 0 Channel Mode	Test Pulse from Test Output
	Safety Input 0 Test Source	Test Output 0
	Dual-channel Safety Input 0/1 Mode	Dual-channel Equivalent
	Dual-channel Safety Input 0/1 Discrepancy Time	100 x 10 ms (application dependent)
Safety Input 1	Safety Input 1 Channel Mode	Test Pulse from Test Output
	Safety Input 1 Test Source	Test Output 1
Safety Input 11	Safety Input 11 Channel Mode	Used as Standard Input
	Safety Input 11 Test Source	Not Used
	Dual-channel Safety Input 10/11 Mode	Single Channel
Test Output 0	Test Output 0 Mode	Pulse Test Output
Test Output 1	Test Output 1 Mode	Pulse Test Output

This example shows wiring and configuration when using the 1791DS-IB12 module with limit switch dual-channel inputs and a manual reset. If used in combination with the programs in a safety controller, this wiring is Category 4 in accordance with EN954-1 wiring requirements.

1791DS-IB8XOB8 Solid State Outputs for Dual-channel Mode



E1: 24V dc Power Source

L1, L2: Loads

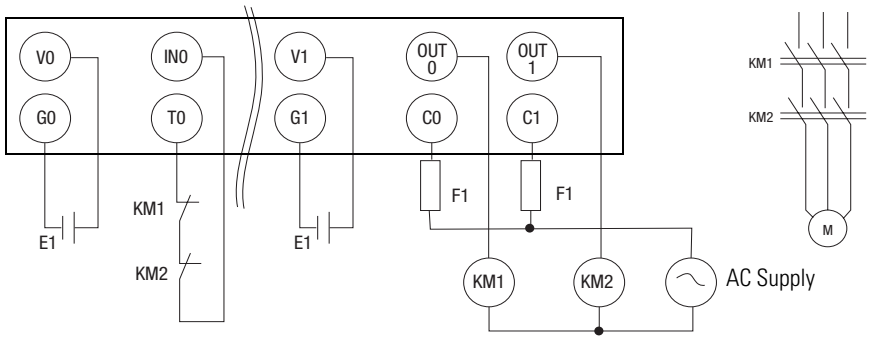
1791DS-IB8XOB8 Solid State Outputs for Dual-channel Mode

Controller Configuration	Parameter Name	Value
Safety Output 0	Safety Output 0 Channel Mode	Safety Pulse Test
	Dual-channel Safety Output 0/1 Mode	Dual-channel
Safety Output 1	Safety Output 1 Channel Mode	Safety Pulse Test

The example shows wiring and configuration when using the 1791DS-IB8XOB8 module with solid state outputs for Dual-channel mode.

If used in combination with the programs of the safety controller, this wiring is Safety Category 4 in accordance with EN954-1 wiring requirements.

1791DS-IB4XOW4 Relay Outputs with Dual-channel Mode and EDM Input



E1, E2: 24V dc Power Source
M: Three-phase Motor

KM1, KM2: Magnetic Contactors
F1, F2: Fuses

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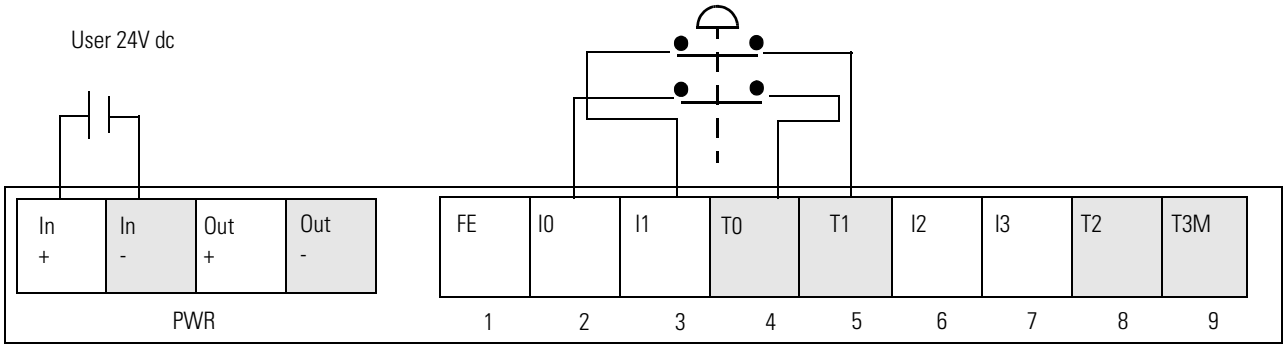
1791DS-IB4XOW4 Relay Outputs with Dual-channel Mode and EDM Input

Controller Configuration	Parameter Name	Value
Safety Input 0	Safety Input 0 Channel Mode	Test Pulse from Test Output
	Safety Input 0 Test Source	Test Output 0
	Dual-channel Safety Input 0/1 Mode	Single Channel
Test Output 0	Test Output 0 Mode	Pulse Test Output
Safety Output 0	Safety Output 0 Channel Mode	Safety
	Dual-channel Safety Output 0/1 Mode	Dual-channel
Safety Output 1	Safety Output 1 Channel Mode	Safety

The example shows wiring and configuration when using a 1791DS-IB4XOW4 module.

When used in combination with the programs of the safety controller, this wiring is Category 4 in accordance with EN954-1 wiring.

1791DS-IB8XOBV4 Dual Safety Inputs



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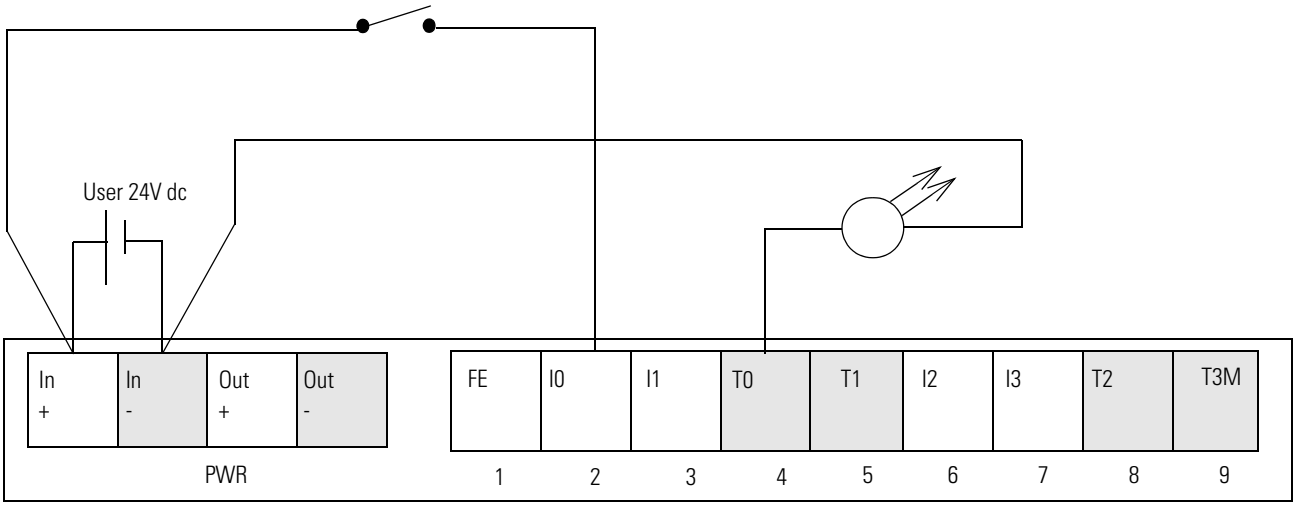
1791DS-IB8XOBV4 Dual Safety Inputs

Controller Configuration	Parameter Name	Value
Safety Input 0	Safety Input 0 Channel Mode	Test Pulse from Test Output
	Safety Input 0 Test Source	Test Output 0
	Dual-channel Safety Input 0/1 Mode	Dual-channel Equivalent
	Dual-channel Safety Input 0/1 Discrepancy Time	100 x 10 ms (application dependent)
Safety Input 1	Safety Input 1 Channel Mode	Test Pulse from Test Output
	Safety Input 1 Test Source	Test Output 1
Test Output 0	Test Output 0 Mode	Pulse Test Output
Test Output 1	Test Output 1 Mode	Pulse Test Output

The example shows wiring and configuration when using a 1791DS-IB8XOBV4 module.

When used in combination with the programs of the safety controller, this wiring is Category 4 in accordance with EN954-1 wiring.

1791DS-IB8XOBV4 Standard Inputs and Outputs

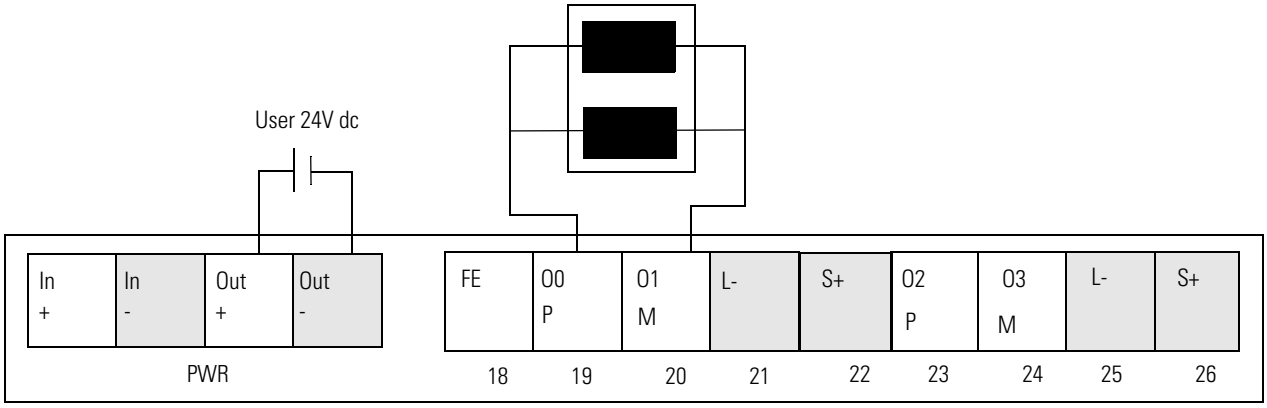


1791DS-IB8XOBV4 Standard Inputs and Outputs

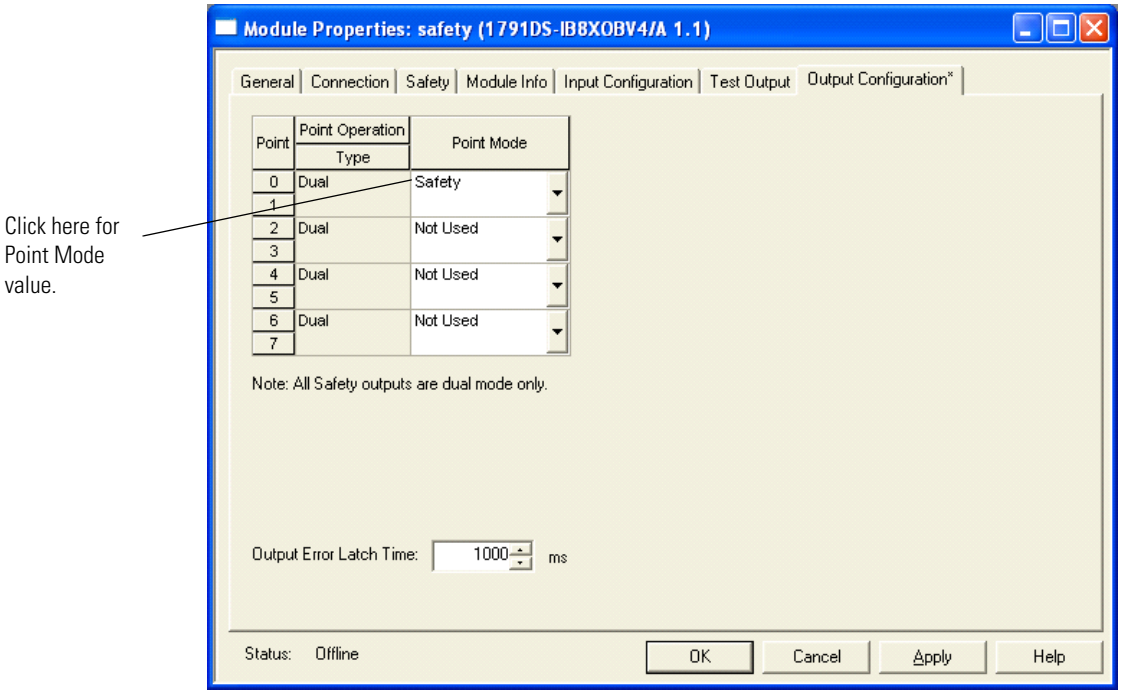
Controller Configuration	Parameter Name	Value
Input 0	Safety Input 0 Channel Mode	Standard Input
Test Pulse 0	Test Output 0 Mode 1	Standard Output

The example shows wiring and configuration when using a 1791DS-IB8XOBV4 module.

1791DS-IB8XOBV4 Dual-load Bipolar Outputs - Example 1



44194



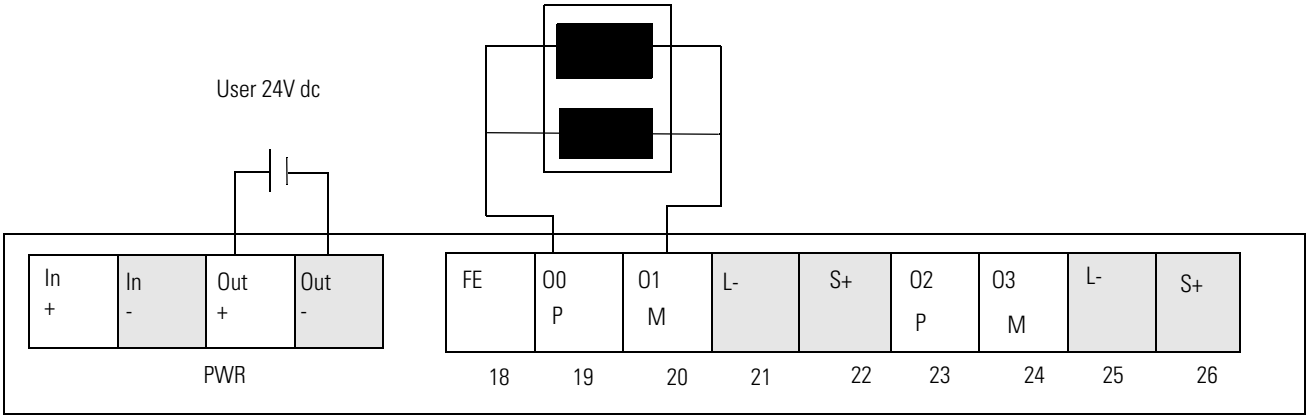
Click here for Point Mode value.

The example shows wiring and configuration when using a 1791DS-IB8XOBV4 module with solid state outputs in Dual-channel mode.

Note that all safety outputs of a 1791DS-IB8XOBV4 module are permanently configured for use as Dual-channel mode only.

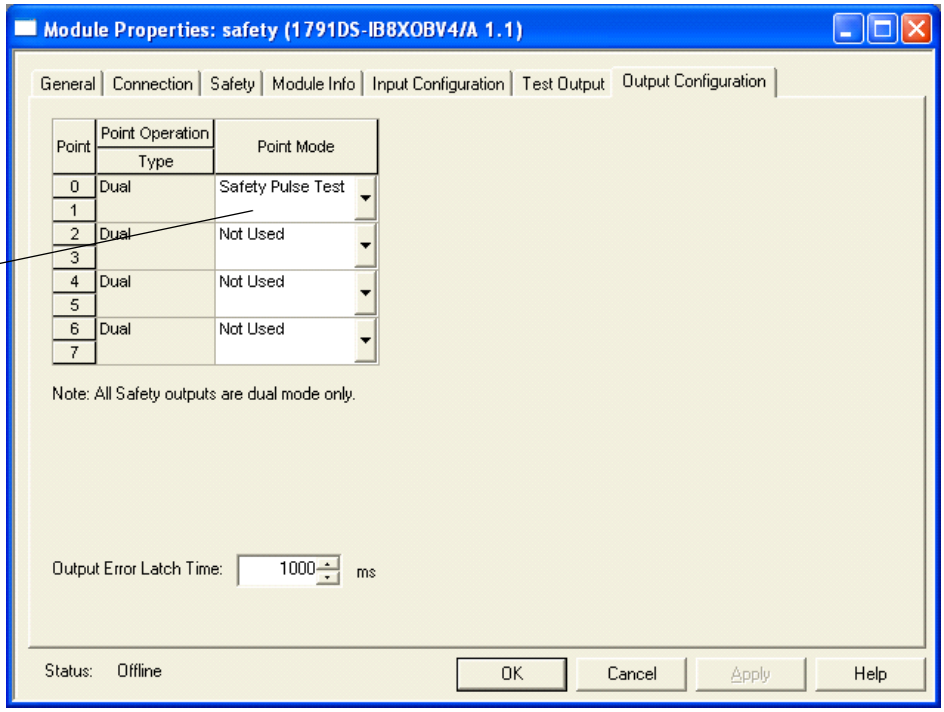
When used in combination with the programs of the safety controller, this circuit configuration is Safety Category 3 in accordance with EN954-1 requirements.

1791DS-IB8XOBV4 Dual-load Bipolar Outputs - Example 2



44194

Click here for Point Mode value.



The example shows wiring and configuration when using a 1791DS-IB8XOBV4 module with solid state outputs in Dual-channel mode.

Note that all safety outputs of a 1791DS-IB8XOBV4 module are permanently configured for use as Dual-channel mode only.

When used in combination with the programs of the safety controller, this circuit configuration is Safety Category 4 in accordance with EN954-1 requirements.

Interpret the LED Indicators

What This Chapter Contains

This chapter includes an explanation of the meaning of module indicators.

1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4 Module LED Indicators

See this section for information on how to interpret these module indicators.

- MS/NS indicators - The MS (module status) indicator displays the status of a node on the network. The NS (network status) indicator displays the status of the entire network. The MS and NS indicators can be green or red and on, flashing, or off.

  See the table for meanings indicated by the combination of colors and status.

- LOCK indicator - The configuration lock indicator displays that the configuration data has been locked by using RSNetWorx for DeviceNet software.
- IN PWR/OUT PWR indicators - The IN PWR and OUT PWR indicators displays the status of I/O power supplied to the module.
- I/O indicators - The I/O indicators display how the on/off and fault status of I/O points on each module.

MS/NS Indicators

State	Status	Description	Recommended Action
MS: Solid Green NS: Solid Green	Normal Operation Online/Connected	Safety I/O communication in progress.	None - normal status - safety I/O communication and standard I/O communication are being performed.
MS: Flashing Green NS: Solid Green	Standby Online/Connected	Standard I/O communication or message communication in progress.	None - normal status - standard I/O communication and/or message communication are being performed.
MS: Flashing Green NS: Off	Standby Not Online Or Not Powered	Waiting for completion of node address duplication check at the master.	If this indicator status occurred for only specific module terminals, check that the module communication rate settings are correct and restart the module.
MS: Flashing Green NS: Flashing Green	Standby Online/Not Connected	Waiting for safety or standard connection.	None - wait for connection to complete.
MS: Flashing Green/Red NS: Off	Initialization Status Not Online or Not Powered	Module performing initialization process or waiting for configuration.	None - wait for process or configuration to complete.
MS: Solid Red) NS: Off	Fatal Fault Not Online or Not Powered	Watchdog timer error.	Replace the module.
MS: Flashing Red NS: Off	Minor Fault Not Online or Not Powered	Switch settings are incorrect.	Check the switch settings and restart the module.
MS: Flashing Green NS: Solid Red	Standby Fatal Link Fault	Node address duplication.	Reset the module so that it has a unique node address, and then restart the module.
MS: Flashing Green NS: Solid Red	Standby Fatal Link Fault	Bus Off status (communication stopped due to consecutive data errors).	Check the following items and restart the module. Do master and module communication rates match? Are lengths of cables (trunk and branch lines) correct? Are cables broken or loose? Are terminating resistors connected to both ends of the trunk line only? Is noise interference excessive?
MS: Flashing Green NS: Flashing Red	Standby Minor Communi-cations Fault	Communication timeout.	Check the following items and restart the module. Do master and module communication rates match? Are lengths of cables (trunk and branch lines) correct? Are cables broken or loose? Are terminating resistors connected to both ends of the trunk line only? Is noise interference excessive? Is the network grounded properly ?

: Lit : Flashing : Not lit

MS/NS Indicators

Indicator	State	Status	Description	Recommended Action
MS	Solid Green	Normal	Normal operating status.	None - normal operation.
	Flashing Green	Standby	Waiting for safety communication from the safety controller .	Wait for module to establish communication.
	Solid Red	Fatal Fault	Hardware fault.	Check for electrical noise and eliminate source. If problem persists, replace module.
	Flashing Red	Minor Fault	Switch settings incorrect.	Correct switch settings.
	Flashing Green/Red	Initialization Status	The module is performing initialization process or waiting for configuration.	Wait for configuration to complete.
	Off	No Power	Power is not being supplied to the module. Waiting for initial processing to start. The module is being reset.	Supply power to module. Wait for processing to start or module to reset.
NS	Solid Green	Online/ Connected	Network is operating normally (communication established).	None - normal operation.
	Flashing Green	Online/Not Connected	Network is operating normally, however, communication are not established.	Verify your network and module configuration.
	Solid Red	Fatal Link Failure	Communication fault. Module detected that network communication are not possible. Node address duplication detected. BusOff fault detected.	Correct communication fault.
	Flashing Red	Minor Commu-nications Fault	Communication timeout.	Correct communication fault.
	Off	Not Online Or Not Powered	Waiting for node address duplication check at the master or the power supply is off.	Wait for check to complete or apply power.

Configuration Lock Indicator

Indicator	State	Description	Recommended Action
Lock	Solid Yellow	Normal configuration, and configuration is locked by RsNetworx for DeviceNet software.	None.
	Flashing Yellow	Normal configuration, but configuration is not locked in the module.	None.
	Off	Configuration has not been performed.	Perform configuration.

IN PWR/OUT PWR Indicators

Indicator	State	Description	Recommended Action
IN PWR	Solid Green	Normal status of input power.	None.
	Off	Input power is not supplied.	Apply input power.
OUT PWR	Solid Green	Normal status of output powe.	None.
	Off	Output power is not supplied. Output power exceeds the upper/lower limit of power range.	Supply output power. Correct output power.

.

IMPORTANT The I/O indicators are not lit while the module is being configured.

I/O Indicators

Indicator	State	Description	Recommended Action
IN0…INn(1)	Solid Yellow	Safety input is on.	None.
	Off	Safety input if off.	None.
	Solid Red	A fault occurred in an input circuit.	Check connected device and wiring.
	Flashing Red	When dual channels are set: a fault occurred in the other channel.	Correct fault in other channel.
OUT0…OUTn(1)	Solid Yellow	Safety output is on.	None.
	Off	Safety output is off.	None.
	Solid Red	A fault occurred in an output circuit.	Check connected device and wiring.
	Flashing Red	When dual channels are set: a fault occurred in the other channel.	Correct fault in other channel.

(1) Where n indicates the input/out number.

1791DS-IB8XOBV4, 1791DS-IB16, 1732DS-IB8XOBV4, 1732DS-IB8 Module LED Indicators

See this section for information on how to interpret module indicators.

24V dc Input Power Indicator

State	Status	Description	Recommended Action
Off	No Power	No power is applied.	Apply power to this section.
Solid Green	Normal Operation	The applied voltage is within specifications.	None.
Solid Yellow	Input Power Out of Specification	The input power is out of specification. For additional information, see the applicable installation instructions.	Check your configuration, wiring, and voltages and apply the changes.

24V dc Output Power Indicator

State	Status	Description	Recommended Action
Off	No Power	No power is applied.	Apply power to this section.
Solid Green	Normal Operation	The applied voltage is within specifications.	None.
Solid Yellow	Output Power Out of Specification	The output power is out of specification. For additional information, see the applicable installation instructions.	Check your configuration, wiring, and voltages and apply the changes.

Module Status Indicator

State	Status	Description	Recommended Action
Off	No Power or Autobauding	No power is applied to the DeviceNet connector.	Apply power to this connector.
Solid Green	Normal Operation	The module is operating normally.	None.
Solid Red	Unrecoverable Fault	The module has detected an unrecoverable fault.	Cycle power to the module. If problem persists, replace the module.
Flashing Green	Module Needs Commissioning Due to Missing, Incomplete, or Incorrect Configuration	Module is unconfigured.	Reconfigure the module. For additional information, inspect Network Status indicator.
Flashing Red	Recoverable Fault or User-initiated Firmware Update	The module has detected a recoverable fault or user-initiated firmware update is in progress.	Cycle power to the module or reset the module.
Flashing Red and Green	Device in Self Test	The module is performing its power-cycle diagnostic tests.	Wait for the module to complete its power-cycle diagnostics.

Network Status Indicator

State	Status	Description	Recommended Action
Off	Module Not Online or No Power	The module is not online with the network.	Verify your network.
Flashing Green	Module Online With No Connections in Established State	The module identified the communication rate of the network but no connections are established.	Verify your network and module configuration.
Solid Green	Module Online with Connections in Established State	The module is operating normally.	None.
Flashing Red	One or more I/O Connections in Timed-out State or User-initiated Firmware Update	The module detected a recoverable network fault, or user-initiated firmware update is in progress.	Verify your network and module configuration.
Solid Red	Critical Link Failure	The module detected an error that prevents it from communicating on the network.	Cycle power to the module, If problem persists, replace the module.
Flashing Red and Green	Communication Faulted Module	The module detected a network access error and is in communication faulted state. The module has received and accepted an Identity Communication Faulted Request-long protocol message.	Verify your network and module configuration.

Configuration Lock Indicator

Indicator	State	Description	Recommended Action
Off	No configuration or the configuration is owned by a CIP safety originator, such as GuardLogix	Invalid configuration data.	None.
Solid Yellow	Locked	Valid configuration, locked by a network configuration tool such as RSNetWorx for DeviceNet software.	None.
Flashing Yellow	Not locked	Valid configuration, owned by a software configuration tool such as RSNetWorx for DeviceNet software.	None.

Safety Input Status Indicator

State	Status	Description	Recommended Action
Off	Safety Input Off Or Module Being Configured	The safety input is off or the module is being configured.	Turn the safety input on or wait for the module to be configured.
Solid Yellow	Safety Input On	The safety input is on.	None.
Solid Red	Fault Detected	A fault in the external wiring or input circuit detected.	Check configuration, field wiring, and devices. If no problem found, replace module.
Flashing Red	Partner Fault Detected	A fault in the partner input circuit of a dual input configuration detected.	Check the field wiring and verify your configuration for the partner circuit. If no problem found, replace module.

Test Output Status Indicator (1791DS-IB8XOBV4 only

State	Status	Description	Recommended Action
Off	Test Output Off Or Module Being Configured	The test output is off or the module is being configured.	Turn the test output on or wait for the module to be configured.
Solid Yellow	Output On	Output is on.	None.
Solid Red	Fault Detected	A fault in the external wiring or input circuit detected.	Check field wiring. If no problem found, replace module. For outputs configured for muting could indicate undercurrent or burned-out lamp.

Safety Output Status Indicator

State	Status	Description	Recommended Action
Off	Safety Output Off Or Module Being Configured	The safety output is off or the module is being configured.	Turn the safety output on or wait for the module to be configured.
Solid Yellow	Safety Output On	The safety output is on.	None.
Solid Red	Fault Detected	A fault in the output circuit was detected.	Check the circuit wiring and end device. If no problem found, replace module.
		Both tags in a dual channel circuit do not have the same value.	Make sure logic is driving tag values to the same state (off or on).
Flashing Red	Partner Fault Detected	A fault in the partner output circuit of a dual output configuration was detected.	Check the circuit wiring and end device of the partner. If no problem found, replace module.

Maintain Your Modules

What This Chapter Contains

This chapter includes information about troubleshooting and maintenance.

Troubleshoot

I/O errors can be read from safety input status, test output status, and safety output status indicators.

- Status data when I/O is normal (OK): ON (1)
- Status data when a fault (Alarm) occurs I/O: OFF (0)

The details of errors can be read by using explicit messages.

See the tables that show safety input errors, test output errors, and safety output errors.

IMPORTANT For I/O error latch-time settings, the OFF status is maintained for at least the error latch time (0…65,530 ms, in increments of 10 ms) when individual safety-input status turns OFF.

Safety Input Error

Code (hex)	Error Content	Probable Cause	Recommended Action
01	Configuration invalid	The configuration is invalid.	Configure the module correctly.
02	External test signal error	1) The power source (positive side) is in contact with the input signal line. 2) Short-circuit between input signal lines. 3) Trouble with the connected device.	1) Check the wiring. 2) Replace the connected device.
03	Internal input error	Trouble with the internal circuit.	Replace the module.
04	Discrepancy error	1) Ground fault or break in an input signal line. 2) Trouble with the connected device.	1) Check the wiring. 2) Replace the connected device.
05	Error in the other dual channel input	Dual channels are set and an error occurred in the other channel.	Remove the error in the other channel.

Explicit Message for Reading the Cause of the Safety Input Error

Explicit Message	Read/ Write	Function	Command (hex)					Response (hex)
			Service Code	Class ID	Instance ID	Attribute ID	Data Size	
Safety Input Cause of Error Information Read	Read	Reads the cause for the normal (OK) flag (1…4) specified by the instance ID[1]	0E	3D	01…0C	6E	-	0: No error 01: Configuration invalid 02: External test signal error 03: Internal input error 04: Discrepancy error 05: Error in the other dual-channel input

(1) The instance numbers for safety input 0…11 are 1…12 (0…0C hex), respectively.

Test Output Error

Code (hex)	Error Content	Probable Cause	Recommended Action
01	Configuration invalid	The configuration is invalid.	Configure the module correctly.
02	Overload detected	1) Ground fault or short-circuit of an output signal line. 2) Trouble with the connected device.	1) Check the wiring. 2) Replace the connected device.
05	Output ON error	1) The power source (positive side) is in contact with the output signal line. 2) Trouble with the internal circuits.	1) Check the wiring. 2) Replace the module.
06	Undercurrent detected for muting lamp	Trouble with the connected device.	Replace the connected device.

Explicit Message for Reading the Cause of the Test Output Error

Explicit Message	Read/ Write	Function	Command					Response (hex)
			Service Code (hex)	Class ID (hex)	Instance ID (hex)	Attribute ID (hex)	Data Size	
Test Output Cause of Error Information Read	Read	Reads the cause for the normal (OK) flag (1…4) specified by the instance ID[1]	OE	09	01…08	76	-	0:No Error 01: Configuration invalid 02: Overload detected 05: Output ON error detected 06: Undercurrent detected for muting lamp

[1]The instance numbers for test outputs 0…7 are 1…8 (01…08 hex), respectively.

Safety Output Errors

Code (hex)	Error Content	Probable Cause	Recommended Action
01	Configuration invalid	The configuration is invalid.	Configure the module correctly.
02	Over current detected	Trouble with the connected device.	Replace the connected device.
03	Short-circuit detected	Ground fault of the output signal line.	Check the wiring.
04	Output ON error	1) The power source (positive side) is in contact with the output signal line. 2) Trouble with the internal circuit.	1)Check the wiring. 2)Replace the module.
05	Error in the other dual channel output	Dual channels are set and an error occurred in the other channel.	Remove the error in the other channel.
06	Internal-relay output circuit error	Trouble with the internal circuit (1791DS-IB4XOW4 module only).	Replace the module.
07	Relay error	Trouble with the relay (1791DS-IB4XOW4 module only).	Replace the relay.
08	Output data error	Wrong setting for output data.	Check the program.
09	Short-circuit detected in output	Short-circuit between output signal lines.	Check the wiring.

Explicit Message for Reading the Cause of the Safety Output Error

Explicit Message	Read/ write	Function	Command					Response
			Service Code (hex)	Class ID (hex)	Instance ID (hex)	Attribute ID (hex)	Data Size (hex)	
Safety Output Cause of Error Information Read	Read	Reads the cause for the normal (OK) flag (No. 1…8) specified by the Instance ID.**[1]	0E	3B	0…08	6E	-	0: No error 01: Configuration invalid 02: Overcurrent detected 03: Short circuit detected 04: Output ON error 05: Error in the other dual channel output 06: Internal relay output circuit error (replace module) 07: Internal relay output circuit error (replace relay) 08: Output data error 09: Short-circuit detected in output

[1] The instance numbers for safety outputs 0…7 are 1…8 (01…08 hex), respectively.

Maintenance

Read this section for information about routine cleaning and inspection recommended as regular maintenance. Handling methods when replacing the module are also explained here.

Clean the Modules

Clean the module regularly using these guidelines to keep the network in optimal operating condition.

- Wipe the module with a dry, soft cloth for regular cleaning.
- When dust or dirt cannot be removed with a dry cloth, dampen the cloth with a neutral cleanser (2%), wring out the cloth, and wipe the module.
- When cleaning, remove smudges that remain on the module from gum, vinyl, or tape left on for a long time.

IMPORTANT Never use volatile solvents, such as paint thinner, benzene, or chemical wipes, to clean the module. These substances may damage the surface of the module.

Inspect the Modules

Inspect the system periodically to keep it in optimal operating condition. In general, inspect the system once every 6 or 12 months, but inspect more frequently if the system is used in high-temperature, humid, or dusty conditions.

Prepare the following equipment before inspecting the system.

- Equipment required for regular inspection
  - Phillips screwdriver
  - Flat-blade screwdriver
  - Screwdriver for connecting communication connectors
  - Tester (or digital voltmeter)
  - Industrial alcohol and clean cloth
- Other equipment that can be required
  - Synchroscope
  - Oscilloscope
  - Thermometer or hygrometer

Check the items indicated in the table and correct any condition that is below standard.

Inspection Items

Inspection Item	Details	Standard	Equipment
Environmental conditions	Are ambient and cabinet temperatures correct?	Refer to the specifications for each module	Thermometer
	Are ambient and cabinet humidity correct?	Refer to the specifications for each module	Hygrometer
	Has dust or dirt accumulated?	No dust or dirt	Visual inspection
Installation conditions	Are the units installed securely?	No loose units	Phillips screwdriver
	Are the connectors of the communication cables fully inserted?	No loose connectors	Flat-blade screwdriver
	Are the external wiring screws tight?	No loose wiring screws	Flat-blade screwdriver
	Are the connecting cables undamaged?	No external damage	Visual inspection
Safety relays operation	Does the safety relay contact go to OFF state?	No welded contact	Visual inspection

ATTENTION

The maintenance interval for relay contacts must not exceed a period of 6 months to fulfill category 4 in accordance with EN 954-1.

G7SA-2A2B must be used when replacing safety relays.

Replace Modules

The network consists of the DeviceNet master unit and safety I/O modules. The entire network is affected when a safety I/O module is faulty, so a faulty module must be repaired or replaced quickly. We recommend having spare modules available to restore network operation as quickly as possible.

Observe the following precautions when replacing a faulty module.

- After replacement, be sure there are no errors with the new module.
- When returning a module for repair, attach a detailed description of the problem and return the module to your Rockwell Automation representative.
- If there is a faulty contact, wipe the contact with a clean, lint-free cloth dampened with alcohol.

IMPORTANT Perform a system test of the related safety functions after replacing a module.

After replacing a module, set the new module's switches to the same settings that were on the old module. For related information see the following publications.

- GuardLogix Controllers User Manual, publication 1756-UM020, for information on replacing a module in the system
- GuardLogix Controller Systems Safety Reference Manual, publication 1756-RM093, for safety considerations when replacing I/O

DeviceNet Explicit Messages

What This Appendix Contains

This appendix lists DeviceNet explicit messages sent from the master unit to a safety I/O module that you can use to read or write any parameter of a specified safety I/O module. The safety I/O module processes the commands sent from the master and then returns responses.

Basic Format of Explicit Messages

The basic format of each command and response is as follows.

Command Block

Destination Node Address	Service Code	Class ID	Instance ID	Attribute ID	Data

- Destination Node Address - The node address of the module that is sending the explicit messages is specified with a 1 byte hexadecimal.
- Service Code, Class ID, Instance ID, Attribute ID - The parameters used for specifying the command, processing object, and processing content.
- Data - Data is not required when the read command is used.

Response block information is as follows.

Normal Response Block

Number of Bytes Received	Source Node Address	Service Code	Data

Error Response Block

Number of Bytes Received 0004 hex (fixed)	Source Node Address	Service Code	Error Code

- Number of Bytes Received - The number of bytes received from the source node address is returned in hexadecimal. When an error response is returned for an explicit message, the number of bytes is always 0004 hex.
- Source Node Address - The node address of the node from which the command was sent is returned in hexadecimal.

- Service Code - For normal completions, the service code specified in the command with the leftmost bit turned ON is stored as shown in the following table.

Function, Command Service Code, and Response Service Code

Function	Command Service Code (hex)	Response Service Code (hex)
Read Data	10	90
Write Data	0E	8E
Reset	05	85
Save	16	96

When an error response is returned for an explicit message, the value is always 94 hex.

- Data - Read data is included only when a read command is executed.
- Error code - The explicit message error code. For details, refer to the list of error codes in the following table.

Error Codes

Response Code (hex)	Error Name	Cause
08FF	Service not supported	The service code is incorrect.
09FF	Invalid attribute value	The specified attribute value is not supported. The data written was outside valid range.
16FF	Object does not exist	The specified instance ID is not supported.
15FF	Too much data	The data is larger than the specified size.
13FF	Not enough data	The data is smaller than the specified size.
0CFF	Object state conflict	The specified command cannot be executed due to an internal error.
20FF	Invalid parameter	The specified operation command data is not supported.
0EFF	Attribute is not setable	An attribute ID supported only for reading has been executed for a write service code.
10FF	Device state conflict	The specified command cannot be executed due to an internal error.
14FF	Attribute not supported	The specified attribute is not supported.
19FF	Store operation failure	The data cannot be stored in memory.
2AFF	Group 2 only server general failure	The specified command or attribute is not supported or the attribute was not set.

Explicit Messages

Reading General Status

Explicit Message	Read/ Write	Function	Command (hex)					Response
			Service Code	Class ID	Instance ID	Attribute ID	Data Size	
General Status Read	Read	Read the specified Slave's status flags (8 bits).	0E	95	01	65	-	1 byte Bit 0: Input power error Bit 1: Output power error Bit 2…7: Reserved

Setting and Monitoring a Safety Input

Explicit Message	Read/ Write	Function	Command (hex)					Response (hex)
			Service Code	Class ID	Instance ID	Attribute ID	Data Size	
Safety Input Cause of Error Information Read	Read	Reads the cause for the normal flag (1…12) specified by the Instance ID turning OFF.	0E	3D	01…0C	6E	-	0: No error 01: Configuration invalid 02: External test signal error 03:Internal input error 04: Discrepancy error 05: Error in the other dual channel input

Setting a Safety Output

Explicit Message	Read/ Write	Function	Command (hex)					Response (hex)
			Service Code	Class ID	Instance ID	Attribute ID	Data Size	
Safety Output Cause of Error (Fault) Information	Read	Reads the cause for the normal flag (1…8) specified by the Instance ID turning OFF.	0E	3B	01…08	6E	-	0: No error 01 : Configuration invalid 02 : Over current detected 03 : Short circuit detected 04 : Output ON error 05 : Error in the other dual channel output 06 : Internal-relay output circuit error (replace module) 07 : Relay failure (replace relay) 08 : Dual channel violation 09 : Short circuit detected at safety output

Monitoring the Test Output Point

Explicit Message	Read/ Write	Function	Command (hex)					Response (hex)
			Service Code	Class ID	Instance ID	Attribute ID	Data Size	
Safety Output Cause of Error (Fault) Information	Read	Reads the cause for the normal flag (1…8) specified by the Instance ID turning OFF.	0E	09	01…04	6E	-	0 = No error 01 : Configuration invalid 02 : Overload detected 03 : Cross circuit detected 05 : Output ON error 06 : Undercurrent detected for muting lamp

Setting Hold/Clear for Communication Errors (Test Output)

Explicit Message	Read/ Write	Function	Command (hex)					Response (hex)
			Service Code	Class ID	Instance ID	Attribute ID	Data Size	
Setting for Output Status (Hold or Clear) after Communication Error	Read	Reads whether hold or clear is set as the output status after a communication error for an output specified by the instance ID. The setting can be read for a specified number of points.	0E	09	01…08	05	-	1 byte 00 : Clear 01 : Hold
Setting for Output Status (Hold or Clear) after Communication Error	Write	Sets whether hold or clear as the output status after a communication error for an output specified by the instance ID. The setting can be read for a specified number of points.	10	09	01…08	05	1 byte 00 : Clear 01 : Hold	

Probability of Failure on Demand (PFD), Probability of Failure per Hour (PFH), and Mean Time Between (MTBF) Data

What This Appendix Contains

This appendix lists calculated values for probability of failure on demand, probability of failure per hour, and mean time between failure.

Calculated Values

See the table that shows the values.

Calculated values of probability of failure on demand and probability of failure per hour appear in the table and must be calculated for the overall devices within the system to comply with the SIL level required for application.

IMPORTANT The proof test interval of the 1791DS-IB4XOW4 module must not exceed 0.5 years because the maintenance interval for the relay contacts must not exceed a period of 6 months to satisfy safety category 4 in accordance with EN954-1.

Within the proof test interval, every I/O module must be functionally tested by individually toggling each input point and verifying that it is detected by the controller. Additionally, each output point must be individually toggled by the controller and user-verified that the output point changes state.

Calculated Values for Probability of Failure on Demand (PFD) - 1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4

Proof Test Interval		1791DS-IB12	1791DS-IB8XOB8	1791DS-IB4XOW4
Years	Hours			
0.25	2190	2.202E-07	2.213E-07	4.697E-06
0.5	4380	4.384E-07	4.395E-07	9.532E-06
1	8760	8.757E-07	8.768E-07	1.963E-05
2	17,520	1.754E-06	1.755E-06	4.151E-05
5	43,800	4.419E-06	4.421E-06	1.207E-04
10	87,600	8.962E-06	8.963E-06	2.978E-04

Calculated Values for Probability of Failure per Hour (PFH) - 1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4

Proof Test Interval		1791DS-IB12	1791DS-IB8XOB8	1791DS-IB4XOW4
Year	Hour			
0.25	2190	2.009E-10	2.019E-10	4.201E-09
0.5	4380	1.999E-10	2.004E-10	4.200E-09
1	8760	1.994E-10	1.996E-10	4.199E-09
2	17,520	1.991E-10	1.992E-10	4.199E-09

Calculated Values for Mean Time Between Failure (MTBF) - 1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4

Model	MTBF (hour)
1791DS-IB12	4.02E+05
1791DS-IB8XOB8	2.64+05
1791DS-IB4XOW4	1.44E+05

Calculated Values for Probability of Failure on Demand (PFD), Probability of Failure per Hour (PFH), and Mean Time Between Failure (MTBF) - SIL 3 - 1791DS-IB8XOBV4, 1732DS-IB8XOBV4, 1791DS-IB16

Model	Proof Test Interval		PFD	PFH (1/hour)	MTBF (hour)
	Year	Hour			
1791DS-IB8XOBV4	1	8760	8.73E-07	2.00E-10	2.36E+06
	2	17,520	1.75E-06		
	5	43,800	4.37E-06		
	10	87,600	8.74E-06		
1732DS-IB8XOBV4	1	8760	8.73E-07	2.00E-10	2.36E+06
	2	17,520	1.75E-06		
	5	43,800	4.37E-06		
	10	87,600	8.74E-06		
1791DS-IB16	1	8760	8.49E-07	1.94E-10	2.42E+06
	2	17520	1.70E-06		
	5	43800	4.25E-06		
	10	87600	8.50E-06		

List of Functions

What This Appendix Contains

This appendix lists functions for the safety I/O modules including safety inputs, test outputs, and safety outputs.

List of Functions

Safety I/O Modules

Item	Description			
Self-diagnosis Function	Self-diagnosis is performed when power is turned ON and periodically during operation. When an error occurs, it is treated as a fatal error, the MS indicator lights in red, and all safety output and output data to the network turn OFF.			
Configuration Lock (Applies to RSNetWorx Software, Does not Apply to RSLogix 5000 Software)	After configuration data has been downloaded and verified, configuration data within the module can be protected. When the data is protected, the LOCK indicator on the front panel lights in yellow. When the data is not protected, the LOCK indicator on the front panel flashes in yellow.			
Automatic Baud Rate Detection	The module is automatically set to the communication rate of the network.			
Contents of Remote I/O Communication	I/O Data for Control	Safety Inputs	The ON/OFF state of each safety input terminal	1791DS -> DeviceNet master Safety Master
		Safety Outputs	The ON/OFF state of each safety output terminal	Safety Master -> 1791DS
		Standard Outputs	The ON/OFF state of each test output terminal (T0…T3)	DeviceNet Master or Safety Master -> 1791DS
	Output Readback	Safety Output Monitors	The actual On/OFF state of each safety output	1791DS -> DeviceNet Master Safety Master
	Status Data	Individual Safety Input Status	Individual Point Input Status (ON = OK, OFF = Fault)	
		Combined Safety Input Status	Combined Input Status (ON = OK, OFF = Fault)	
		Individual Safety Output Status	Individual Point Output Status (ON = OK, OFF = Fault)	
		Combined Safety Output Status	Combined Output Status (ON = OK, OFF = Fault)	
		Individual Test Output Status	Individual Test Output Status (ON = OK, OFF = Fault)	
		Muting Lamp Status	Muting Lamp Status of T3 (ON = OK, OFF = Fault) if T3 is configured for muting lamp operation	

Safety I/O Modules

Item	Description	
Number of Connections	Safety I/O	4 (single-cast, multi-cast) Communication with up to 15 safety controllers for each connection can be performed using multi-casting. When using four connections, a maximum of 30 safety controllers total can communicate with the module.
	Standard I/O	2 (poll, bit-strobe, change of state and cyclic)
Allocation Patterns of Remote I/O Communication	1791DS-IB12, 1732DS-IB8 Module	For remote I/O communication, you can select and allocate the following I/O data: • Safety Input Data • Individual Safety Input Status • Combined Safety Input Status • Muting Lamp Status • Individual Test Output Status • Standard Output Data
	1791DS-IB8XOB8. 1732DS-IB8XOBV4, 1791DS-IB8SOBV4 Module	For remote I/O communication, you can select and allocate the following I/O data: • Safety Input Data • Individual Safety Input Status • Combined Safety Input Status • Combined Safety Output Status • Individual Safety Output Status • Muting Lamp Status • Standard Output Data • Safety Output Readback • Individual Test Output Status
	1791DS-IB4XOW4 Module	For remote I/O communication, you can select and allocate the following I/O data: • Safety Input Data • Individual Safety Input Status • Combined Safety Input Status • Combined Safety Output Status • Individual Safety Output Status • Muting Lamp Status • Standard Output Data • Safety Output Monitor • Individual Test Output Status

Safety Inputs

Item	Description
Input Channel Mode	Any of the following modes can be selected according to the external input device for each input. • Not used - An external input device is not connected. • Safety pulse test - Used with a contact output device in combination with a test output. Using this setting, short circuits between input signal lines and the power supply (positive side) and short circuits between input signal lines can be detected. • Safety - A solid-state output safety sensor is connected. • Standard - A standard device is connected, for example, a reset switch.
Dual-channel Mode	The consistency between signals on two channels can be evaluated. The following settings can be selected. The discrepancy time is set for Dual-channel operation. • Single channel - Used as a single channel. • Dual-channel equivalent - Used as a dual channel pair. Status is OK when both channels are ON or OFF. • Dual-channel complementary - Used as dual channel. Status is OK when one channel is ON and the other channel is OFF.
Input Delays	ON delay - An input signal is treated as being OFF during the ON delay setting time (0…126 ms, in increments of 6 ms) after the input contact's rising edge. The input turns ON only if the input contact remains ON after the ON delay time has elapsed. This helps prevent chattering of the input contacts.
	OFF delay - An input signal is treated as being ON during the OFF delay setting time (0…126 ms, in increments of 6 ms) after the input contact's falling edge. The input turns OFF only if the input contact remains OFF after the OFF delay time has elapsed. This helps prevent chattering of the input contacts.
Input Error Latch Time	An input or test output error is held for a minimum of this amount of time. This time should be set to ensure that the Safety Controller recognizes the error (0…65,530 ms, in increments of 10 ms).

Test Outputs

Item	Description
Test Output Mode	Any of the following modes can be selected to accomodate the connected external device.
	Not used - An external device is not connected.
	Standard output - The output is connected to a standard device.
	Pulse test output - A contact output device is connected and used in combination with a safety input.
	Power supply output - The power supply terminals of a safety sensor are connected. The voltage supplied to I/O power (V,G) is output from the test output terminal.
	Muting lamp output (terminal T3 or T7, depending on module type) - An indicator is connected. Unit is turned on to detect broken lines in an external indicator..
Output Status After Communication Error	A selection to hold or clear the previous value when a communication error occurs is available.
Short Circuit Detection	Supported.
Broken Wire Detection of External Indicator	Supported for muting output only.

Safety Output

Item	Description
Output Channel Mode	Any of the following Safety Output modes can be selected. • Not used - External output devices are not connected. • Safety - When the safety output is ON, the test pulse is not output (remains ON). • Safety pulse test - When the output is ON, the test pulse is turned OFF for 470 µs in a cycle of 648 ms. Using this function, short-circuits between output signal lines and the power supply (positive side) and short-circuits between output signal lines can be detected.
Dual Channel Setting	The consistency between signals on two channels can be evaluated. Either of the following settings can be selected for 1791DS-1791DS-IB8XOB8 and 1791DS-IB4XOW4. Dual-channel is the only setting for 1791DS-IB8XOBV4 and 1732DS-IB8XOBV4. • Single channel - used as single channel. • Dual channel - when both channels are OK, outputs can be turned ON. If an error is detected on one of the channels, the other channel is also turned OFF.
Output Error Latch Time	A safety output error will be held for a minimum of this amount of time. This time should be set to be sure that the safety controller recognizes the error. (0…65,530 ms, in increments of 10 ms)
Short-circuit Protecton	Supported.
Overcurrent Detection	Supported.

Configuration Reference Information

What This Appendix Contains

This appendix provides information about configuration settings.

Understand Parameter Groups

The modules have these parameter groups: general parameters, safety input, test output, and safety output.

See the tables for the settings in each parameter group. All parameters are set by using RSLogix 5000 or RSNetWorx for DeviceNet software.

IMPORTANT Parameters directly related to safety are marked with an X in the left column.

General Parameters

Parameter Name		Value	Description	Default
x	Safety Output Error Latch Time	0…65,530 ms (in increments of 10 ms)	Safety output errors will be latched for this time.	1000 ms
x	Safety Input Error Latch Time	0…65,530 ms (in increments of 10 ms)	Safety input or test output errors will be latched for this time.	1000 ms
	Test Output Idle State	Clear OFF or Keep Output Data	Definition of output data is in idle state.	Clear OFF

Safety Input Parameters

Parameter Name		Value	Description
x	Input Delay Time Off -> On	0…126 ms (in increments of 6 ms)	Filter time for OFF to ON transition.
x	Input Delay Time On -> Off	0…126 ms (in increments of 6 ms)	Filter time for ON to OFF transition.
x	Input Point Mode	Not Used	External input device is not connected.
		Safety Test Pulse	Use with a contact output device and in combination with a test output. Using this setting, short-circuits between input signal lines and the power supply (positive side) and short-circuits between input signal lines can be detected.
		Safety	A solid-state output safety sensor is connected.
		Standard	A standard device, such as a reset switch, is connected.
x	Safety Input Test Source	Not Used	The test output that is used with the input.
		Test Output 0	
		Test Output 1	
		Test Output 2	
		Test Output 3	
x	Input Point Operation Type	Single Channel	Use as single channel.
		Dual-channel Equivalent	Use as dual-channel. Normal (OK) when both channels are ON or OFF.
		Dual-channel Complementary	Use as dual-channel. Normal (OK) when one channel is ON and the other channel is OFF.

IMPORTANT If the test pulse from test output is set to the Safety Input Channel mode, the safety-input test source and pulse test output of the test output must be set to the Test Output mode.

Test Output Parameters

Parameter Name		Value	Description	Default
x	Test Output Mode	Not Used	An external device is not connected.	Not Used
		Standard	The output is connected to a standard device.	
		Pulse Test	A contact output device is connected. Use in combination with a safety input.	
		Power Supply	The power supply of a Safety Sensor is connected. The voltage supplied to I/O power (V, G) is output from the test output terminal.	
		Muting Lamp Output (Terminal T3 or T7 only)	An indicator is connected and turned ON to detect broken lines in an external indicator.	
	Test Output Fault Action	Clear OFF	Action to perform when a communication error is detected.	Clear OFF
		Hold Last Data		

Safety Output Parameters

Parameter Name		Value	Description	Default
x	Output Point Mode	Not Used	An external output devices is not connected.	Not Used
		Safety	When the output is ON, the test pulse is not output (remains ON).	
		Safety Pulse Test	Using this function, short-circuits between output signal lines and the power supply (positive side) and short-circuits between output signal lines can be detected.	
x	Output Point Operation Type	Single Channel	Use as single channel.	Dual-channel
		Dual-channel	Use as dual-channel. When both channels are normal (OK), outputs can be turned ON.	

Allocate Remote I/O

Concerning I/O allocations, the module internally stores I/O data. To set connection paths, use RSLogix 5000 or RSNetWorx for DeviceNet software to allocate I/O data for the master unit. No settings are made by default. Be sure to set the required connection paths.

Concerning I/O data, the module stores the following data:

- SAFETY: Information the controller can use in safety-related functions
- STANDARD: Additional information that must not be relied on for safety functions

Data and Description

Data		Description
Input data	Safety Input Data SAFETY	Indicates the ON/OFF status of each input terminal. • ON: 1 • OFF: 0
	Combined Safety Input Status SAFETY	An AND of the status of all input terminals. • All terminals are normal: 1 • An error was detected in one or more input terminals: 0
	Individual Safety Input Status SAFETY	Indicates the status of each input terminal. • Normal (OK): 1 • Fault (Alarm): 0
	Combined Safety Output Status SAFETY	An AND of the status of all safety output terminals. • All terminals are normal: 1 • An error has been detected in one or more output terminals: 0
	Individual Safety Output Status SAFETY	Indicates the status of each safety output terminal. • Normal (OK): 1 • Fault (Alarm): 0
	Muting Lamp Status SAFETY	Indicates the status when terminal T3 is configured as the muting lamp output. • Normal (OK)I: 1 • Fault (Alarm): 0
	Safety Output Monitor STANDARD	Monitors the outputs of the safety output terminals. • ON: 1 • OFF: 0
	Individual Test Output Status STANDARD	Indicates the status of each of the test output terminals. • Normal (OK): 1 • Fault (Alarm): 0
Output data	Safety Output Data SAFETY	Controls the safety output. • ON: 1 • OFF: 0
	Standard Output Data STANDARD	Controls the test output when Test Output mode is set to a standard output. • ON: 1 • OFF: 0

I/O Data Supported by Each Module

See the tables that show the I/O data supported by each module. Refer to I/O Assembly Data for data arrangements.

For I/O data, safety connections for up to four items, including one output, can be allocated for the master unit, and standard connections for up to two items can be allocated for the master unit (scanner).

1791DS-IB12 Modules

Safety Connection	Standard Connection	Configuration Software Setting (See Module Definition[1])	Assembly Instance No.	Inputs								Outputs	
				Safety Input Data	Combined Safety Input Status	Individual Safety Input Status	Combined Safety Output Status	Individual Safety Output Status	Muting Lamp Status	Safety Output Readback	Individual Test Output Status	Safety Output Data	Standard Output Data
•	•	Safety	20C	•									
•	•	Small Safety - Point Status	224	•		•							
•	•	Safety - Point Status	22C	•		•							
•	•	Safety - Combined Status - Muting Status	310	•	•				•				
		Safety - Point Status - Muting Status	311	•		•			•				
•	•	Safety - Point Status - Muting Status - Test Output Status	312	•		•			•		•		
	•	Test	21										•
	•	Test Output Status with General Status Assembly	340								•		

(1) Found in RSLogix 5000 software, I/O Module Properties, General tab.

1791DS-IB8XOB8 Modules

Safety Connection	Standard Connection	Configuration Software Setting (See Module Definition[1])	Assembly Instance No.	Inputs								Outputs	
				Safety Input Data	Combined Safety Input Status	Individual Safety Input Status	Combined Safety Output Status	Individual Safety Output Status	Muting Lamp Status	Safety Output Readback	Individual Test Output Status	Safety Output Data	Standard Output Data
•	•	Safety	204	•									
•	•	Safety - Combined Status - Muting Status	320	•	•		•		•				
•	•	Safety - Point Status - Muting Status	321	•		•		•	•				
•	•	Safety - Readback - Point Status - Muting Status	322	•		•		•	•	•			
•	•	Safety - Readback - Point Status - Muting Status - Test Output Status	323	•		•		•	•	•	•		
	•	Test	21										•
•		Safety	234									•	
•		Combined	351									•	•
	•	Output Readback/Test Output Status with General Status Assembly	341							•	•		

(1) Found in RSLogix 5000 software, I/O Module Properties, General tab.

1791DS-IB4XOW4 Modules

Safety Connection	Standard Connection	Configuration Software Setting (see Module Definition[1])	Assembly Instance No.	Inputs								Outputs	
				Safety Input Data	Combined Safety Input Status	Individual Safety Input Status	Combined Safety Output Status	Individual Safety Output Status	Muting Lamp Status	Safety Output Readback	Individual Test Output Status	Safety Output Data	Standard Output Data
•	•	Safety	203	•									
•	•	Safety - Combined Status - Muting Status	330	•	•		•		•				
•	•	Safety - Point Status - Muting Status	331	•		•		•	•				
•	•	Safety - Readback - Point Status - Muting Status	332	•		•		•	•	•			
•	•	Safety - Readback - Point Status - Muting Status - Test Output Status	333	•		•		•	•	•	•		
	•	Test	21										•
•		Safety	233									•	
•		Combined	350									•	•
	•	Output Readback/Test Output Status with General Status Assembly	342							•	•		

(1) Found in RSLogix 5000 software, I/O Module Properties, General tab.

1791DS-IB8XOBV4 Modules

Safety Connection	Standard Connection	Configuration Software Setting (see Module Definition[1])	Assembly Instance No.	Inputs								Outputs	
				Safety Input Data	Combined Safety Input Status	Individual Safety Input Status	Combined Safety Output Status	Individual Safety Output Status	Muting Lamp Status	Safety Output Readback	Individual Test Output Status	Safety Output Data	Standard Output Data
•	•	Safety	204	•									
•	•	Safety - Combined Status - Muting	324	•	•		•		•				
•	•	Safety - Point Status - Muting	344	•		•		•	•				
•	•	Safety - Readback - Point Status - Muting	354	•		•		•	•	•			
•	•	Safety - Readback - Point Status - Muting - Test Output	374	•		•		•	•	•	•		
	•	Test	22										•
•		Safety	234									•	
•		Combined	2C4									•	•

(1) Found in RSLogix 5000 software, I/O Module Properties, General tab.

1732DS-IB8 Modules

Safety Connection	Standard Connection	Configuration Software Setting (see Module Definition[1])	Assembly Instance No.	Inputs								Outputs	
				Safety Input Data	Combined Safety Input Status	Individual Safety Input Status	Combined Safety Output Status	Individual Safety Output Status	Muting Lamp Status	Safety Output Readback	Individual Test Output Status	Safety Output Data	Standard Output Data
•	•	Safety	204	•									
•	•	Safety - Point Status - Muting Status	334	•		•		•	•				
•	•	Safety - Point Status - Muting - Test Output	364	•		•			•		•		
•	•	Safety - Combined Status - Muting	314	•	•		•		•				
•	•	Safety - Point Status	224	•		•							
	•	Test	22										•

(1) Found in RSLogix 5000 software, I/O Module Properties, General tab.

1732DS-IB8XOBV4 Modules

Safety Connection	Standard Connection	Configuration Software Setting (see Module Definition[1])	Assembly Instance No.	Inputs								Outputs	
				Safety Input Data	Combined Safety Input Status	Individual Safety Input Status	Combined Safety Output Status	Individual Safety Output Status	Muting Lamp Status	Safety Output Readback	Individual Test Output Status	Safety Output Data	Standard Output Data
•	•	Safety	204	•									
		Safety - Combined Status - Muting	324	•	•		•		•				
•	•	Safety - Point Status - Muting	344	•		•		•	•				
•	•	Safety - Readback - Point Status - Muting	354	•		•		•	•	•			
•	•	Safety - Readback - Point Status - Muting - Test Output	374	•		•		•	•	•	•		
	•	Test	22										•
•		Safety	234									•	
•		Combined	2C4									•	•

(1) Found in RSLogix 5000 software, I/O Module Properties, General tab.

1791DS-IB16 Modules

Safety Connection	Standard Connection	Configuration Software Setting (see Module Definition[1])	Assembly Instance No.	Inputs								Outputs	
				Safety Input Data	Combined Safety Input Status	Individual Safety Input Status	Combined Safety Output Status	Individual Safety Output Status	Muting Lamp Status	Safety Output Readback	Individual Test Output Status	Safety Output Data	Standard Output Data
•	•	Safety	205	•									
•	•	Safety - Point Status - Muting	335	•		•			•				
•	•	Safety - Point Status - Muting - Test Output	365	•		•			•		•		
•	•	Safety - Combined Status - Muting	315	•	•				•				
•	•	Safety - Point Status	225	•		•							
•	•	Test	23										•
		None	C7										

(1) Found in RSLogix 5000 software, I/O Module Properties, General tab.

I/O Assembly and Reference Data

See the tables for I/O assembly and reference data.

1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4 Data

The bits in the tag definitions of RSLogix 5000 and RSNetWorx for DeviceNet software are different than those shown in the following section. The following table defines the name associations for consistency with the programming software.

Bit Definitions and RSLogix 5000 Tag Names

Bit Definitions	RSLogix 5000 Tag Name
Safety Input 0	Pt00Data
Safety Input 11	Pt11Data
Safety Input 0 Status	Pt00InputStatus
Safety Input 11 Status	Pt11InputStatus
Safety In Status	InputStatus
Muting Lamp Status	MutingStatus
Safety Output 0	Pt00Data
Safety Output 7	Pt07Data
Standard Output 0	Test00Data
Standard Output 3	Test03Data
Safety Output 0 Status	Pt00OutputStatus
Safety Output 7 Status	Pt07OutputStatus
Safety Out Status	OutputStatus
Safety Output 0 Monitor	Pt00Readback
Safety Output 7 Monitor	Pt07Readback
Test Output 0 Status	Pt00TestOutputStatus
Test Output 3 Status	Pt03TestOutputStatus

See these tables for reference data concerning input and output data.

Input Data (Catalog Numbers 1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4)

Catalog Number	Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1791DS-IB4XOW4	203	0	Reserved				Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
1791DS-IB8XOB8	204	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
1791DS-IB12	20C	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Reserved				Safety Input 11	Safety Input 10	Safety Input 9	Safety Input 8
1791DS-IB12	224	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
1791DS-IB12	22C	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status	Safety Input 11	Safety Input 10	Safety Input 9	Safety Input 8
		2	Safety Input 11 Status	Safety Input 10 Status	Safety Input 9 Status	Safety Input 8 Status	Safety Input 7 Status	Safety Input 7 Status	Safety Input 5 Status	Safety Input 4 Status
1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4	300	0	Reserved						Output Power Error	Input Power Error
1791DS-IB12	310	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Muting Lamp Status	Combined Safety In Status	Reserved		Safety Input 11	Safety Input 10	Safety Input 9	Safety Input 8
1791DS-IB12	311	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status	Safety Input 11	Safety Input 10	Safety Input 9	Safety Input 8
		2	Safety Input 11 Status	Safety Input 10 Status	Safety Input 9 Status	Safety Input 8 Status	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status
		3	Muting Lamp Status	Reserved						

Input Data (Catalog Numbers 1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4)

Catalog Number	Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1791DS-IB12	312	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status	Safety Input 11	Safety Input 10	Safety Input 9	Safety Input 8
		2	Safety Input 11 Status	Safety Input 10 Status	Safety Input 9 Status	Safety Input 8 Status	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status
		3	Muting Lamp Status	Reserved			Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status
1791DS-IB8XOB8	320	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Muting Lamp Status	Combined Safety In Status	Combined Safety Out Status	Reserved				
1791DS-IB8XOB8	321	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
		2	Safety Output 7 Status	Safety Output 6 Status	Safety Output 5 Status	Safety Output 4 Status	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
		3	Muting Lamp Status	Reserved						
1791DS-IB8XOB8	322	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
		2	Safety Output 7 Status	Safety Output 6 Status	Safety Output 5 Status	Safety Output 4 Status	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
		3	Safety Output 7 Monitor	Safety Output 6 Monitor	Safety Output 5 Monitor	Safety Output 4 Monitor	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor
		4	Muting Lamp Status	Reserved						

Input Data (Catalog Numbers 1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4)

Catalog Number	Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1791DS-IB8XOB8	323	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
		2	Safety Output 7 Status	Safety Output 6 Status	Safety Output 5 Status	Safety Output 4 Status	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
		3	Safety Output 7 Monitor	Safety Output 6 Monitor	Safety Output 5 Monitor	Safety Output 4 Monitor	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor
		4	Muting Lamp Status	Reserved			Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status
1791DS-IB4XOW4	330	0	Muting Lamp Status	Combined Safety In Status	Combined Safety Out Status	Reserved	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
1791DS-IB4XOW4	331	0	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Muting Lamp Status	Reserved			Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
1791DS-IB4XOW4	332	0	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
		2	Muting Lamp Status	Reserved						
1791DS-IB4XOW4	333	0	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
		2	Muting Lamp Status	Reserved			Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status
1791DS-IB12	340	0	Reserved							
		1	Reserved				Test Output 3 Status	Test Output 2 Status	Output Power Error	Input Power Error

Input Data (Catalog Numbers 1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4)

Catalog Number	Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1791DS-IB8XOB8	341	0	Reserved							
		1	Safety Output 7 Monitor	Safety Output 6 Monitor	Safety Output 5 Monitor	Safety Output 4 Monitor	Safety Output 3 Monitor	Safety Output 2 Monitor	Output Power Error	Input Power Error
		2	Reserved				Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status
1791DS-IB4XOW4	342	0	Reserved							
		1	Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor

Output Data (Catalog Numbers 1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4)

Catalog Number	Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4	21	0	Reserved				Standard Output 3	Standard Output 2	Standard Output 1	Standard Output 0
1791DS-IB4XOW4	233	0	Reserved				Safety Output 3	Safety Output 2	Safety Output 1	Safety Output 0
1791DS-IB8XOB8	234	0	Safety Output 7	Safety Output 6	Safety Output 5	Safety Output 4	Safety Output 3	Safety Output 2	Safety Output 1	Safety Output 0
1791DS-IB4XOW4	350	0	Standard Output 3	Standard Output 2	Standard Output 1	Standard Output 0	Safety Output 3	Safety Output 2	Safety Output 1	Safety Output 0
1791DS-IB8XOB8	351	0	Safety Output 7	Safety Output 6	Safety Output 5	Safety Output 4	Safety Output 3	Safety Output 2	Safety Output 1	Safety Output 0
		1	Reserved				Standard Output 3	Standard Output 2	Standard Output 1	Standard Output 0

1732DS-IB8, 1732DS-IB8XOBV4, 1791DS-IB8XOBV4, and 1791DS-IB16 Data

The bits in the tag definitions of RSLogix 5000 and RSNetWorx software are different than those shown in the following section. The following table defines the name associations for consistency with the programming software.

Bit Definitions and RSLogix 5000 Tag Names

Bit Definitions	RSLogix 5000 Tag Name
Safety Input 0…7	Module Name:I.Pt00Data - Pt15Data
Safety Input 0…7 Status	Module Name:I.Pt00InputStatus - Pt15InputStatus
Combined Safety In Status	Module Name:I.InputStatus
Muting Lamp Status	Module Name:I.MutingStatus
Safety Output 0…7	Module Name:O.Pt00Data - Pt07Data
Safety Output 0…7 Status	Module Name:I.Pt00OutputStatus - Pt07OutputStatus
Combined Safety Out Status	Module Name:I.OutputStatus
Safety Output 0…7 Monitor	Module Name:I.Pt00Readback - Pt07Readback
Test Output 0…7 Data	Module Name:I.Test00Data - Test07Data
Test Output 0…7 Status	Module Name:I.Pt00TestOutputStatus - Pt07TestOutputStatus

See these tables for reference data concerning input and output data.

Input Data (Catalog Numbers 1732DS-IB8, 1732DS-IB8XOBV4, 1791DS-IB8XOBV4, 1791DS-IB16)

Catalog Number	Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1732DS-IB8, 1732DS-IB8XOBV4, 1791DS-IB8XOBV4	204	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
	224	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
1791DS-IB16	205	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
			Safety Input 15	Safety Input 14	Safety Input 13	Safety Input 12	Safety Input 11	Safety Input 10	Safety Input 9	Safety Input 8
1791DS-IB16	225	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 15	Safety Input 14	Safety Input 13	Safety Input 12	Safety Input 11	Safety Input 10	Safety Input 9	Safety Input 8
		2	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
		3	Safety Input 15 Status	Safety Input 14 Status	Safety Input 13 Status	Safety Input 12 Status	Safety Input 11 Status	Safety Input 10 Status	Safety Input 9 Status	Safety Input 8 Status
1732DS-IB8, 1791DS-IB16	300	0	Reserved							Input Power Error
1732DS-IB8, 1732DS-IB8XOBV4, 1791DS-IB8XOBV4	301	0	Reserved						Output Power Error	Input Power Error
1732DS-IB8	314	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Reserved						Muting Lamp 7 Status	Muting Lamp 3 Status
1791DS-IB16	315	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 15	Safety Input 14	Safety Input 13	Safety Input 12	Safety Input 11	Safety Input 10	Safety Input 9	Safety Input 8
		2	Combined Safety In Status	Reserved	Reserved	Reserved	Muting Lamp 15 Status	Muting Lamp 11 Status	Muting Lamp 7 Status	Muting Lamp 3 Status
1732DS-IB8XOBV4, 1791DS-IB8XOBV4	324	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Combined Safety In Status	Combined Safety Out Status	Reserved				Muting Lamp 7 Status	Muting Lamp 3 Status

Input Data (Catalog Numbers 1732DS-IB8, 1732DS-IB8XOBV4, 1791DS-IB8XOBV4, 1791DS-IB16)

Catalog Number	Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1732DS-IB8, 1732DS-IB8XOBV4, 1791DS-IB8XOBV4	334	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
		2	Reserved						Muting Lamp 7 Status	Muting Lamp 3 Status
1791DS-IB16	335	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 15	Safety Input 14	Safety Input 13	Safety Input 12	Safety Input 11	Safety Input 10	Safety Input 9	Safety Input 8
		2	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
		3	Safety Input 15 Status	Safety Input 14 Status	Safety Input 13 Status	Safety Input 12 Status	Safety Input 11 Status	Safety Input 10 Status	Safety Input 9 Status	Safety Input 8 Status
		4	Reserved	Reserved	Reserved	Reserved	Muting Lamp 15 Status	Muting Lamp 11 Status	Muting Lamp 7 Status	Muting Lamp 3 Status
1732DS-IB8XOBV4, 1791DS-IB8XOBV4	344	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
		2	Safety Output 7 Status	Safety Output 6 Status	Safety Output 5 Status	Safety Output 4 Status	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
		3	Reserved						Muting Lamp 7 Status	Muting Lamp 3 Status
	354	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
		2	Safety Output 7 Status	Safety Output 6 Status	Safety Output 5 Status	Safety Output 4 Status	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
		3	Safety Output 7 Monitor	Safety Output 6 Monitor	Safety Output 5 Monitor	Safety Output 4 Monitor	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor
		4	Reserved						Muting Lamp 7 Status	Muting Lamp 3 Status

Input Data (Catalog Numbers 1732DS-IB8, 1732DS-IB8XOBV4, 1791DS-IB8XOBV4, 1791DS-IB16)

Catalog Number	Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1732DS-IB8, 1732DS-IB8XOBV4, 1791DS-IB8XOBV4	364	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
		2	Test Output 7 Status	Test Output 6 Status	Test Output 5 Status	Test Output 4 Status	Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status
		3	Reserved						Muting Lamp 7 Status	Muting Lamp 3 Status
1791DS-IB16	365	0	Standard Output 7	Standard Output 6	Standard Output 5	Standard Output 4	Standard Output 3	Standard Output 2	Standard Output 1	Standard Output 0
		1	Standard Output 15	Standard Output 14	Standard Output 13	Standard Output 12	Standard Output 11	Standard Output 10	Standard Output 9	Standard Output 8
		2	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
		3	Safety Input 15 Status	Safety Input 14 Status	Safety Input 13 Status	Safety Input 12 Status	Safety Input 11 Status	Safety Input 10 Status	Safety Input 9 Status	Safety Input 8 Status
		4	Test Output 7 Status	Test Output 6 Status	Test Output 5 Status	Test Output 4 Status	Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status
		5	Test Output 15 Status	Test Output 14 Status	Test Output 13 Status	Test Output 12 Status	Test Output 11 Status	Test Output 10 Status	Test Output 9 Status	Test Output 8 Status
		6	Reserved	Reserved	Reserved	Reserved	Muting Lamp 15 Status	Muting Lamp 11 Status	Muting Lamp 7 Status	Muting Lamp 3 Status
1732DS-IB8XOBV4, 1791DS-IB8XOBV4	374	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
		2	Safety Output 7 Status	Safety Output 6 Status	Safety Output 5 Status	Safety Output 4 Status	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
		3	Safety Output 7 Monitor	Safety Output 6 Monitor	Safety Output 5 Monitor	Safety Output 4 Monitor	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor
		4	Test Output 7 Status	Test Output 6 Status	Test Output 5 Status	Test Output 4 Status	Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status
		5	Reserved						Muting Lamp 7 Status	Muting Lamp 3 Status

Input Data (Catalog Numbers 1732DS-IB8, 1732DS-IB8XOBV4, 1791DS-IB8XOBV4, 1791DS-IB16)

Catalog Number	Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1732DS-IB8	384	0	Reserved							Input Power Error
		1	Test Output 7 Status	Test Output 6 Status	Test Output 5 Status	Test Output 4 Status	Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status
1791DS-IB16	385	0	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Input Power Error
		1	Test Output 7 Status	Test Output 6 Status	Test Output 5 Status	Test Output 4 Status	Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status
		2	Test Output 15 Status	Test Output 14 Status	Test Output 13 Status	Test Output 12 Status	Test Output 11 Status	Test Output 10 Status	Test Output 9 Status	Test Output 8 Status
1732DS-IB8XOBV4, 1791DS-IB8XOBV4	394	0	Reserved						Output Power Error	Input Power Error
		1	Test Output 7 Status	Test Output 6 Status	Test Output 5 Status	Test Output 4 Status	Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status
	3A4	0	Reserved						Output Power Error	Input Power Error
		1	Safety Output 7 Monitor	Safety Output 6 Monitor	Safety Output 5 Monitor	Safety Output 4 Monitor	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor
		2	Test Output 7 Status	Test Output 6 Status	Test Output 5 Status	Test Output 4 Status	Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status

Output Data (Catalog Numbers 1791DS-IB8XOBV4, 1732DS-IB8, 1732-IB8XOBV4)

Catalog Number	Instance (hex)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1791DS-IB8XOBV4, 1732DS-IB8, 1732-IB8XOBV4	22	0	Standard Output 7	Standard Output 6	Standard Output 5	Standard Output 4	Standard Output 3	Standard Output 2	Standard Output 1	Standard Output 0
1791DS-IB16	23	0	Standard Output 7	Standard Output 6	Standard Output 5	Standard Output 4	Standard Output 3	Standard Output 2	Standard Output 1	Standard Output 0
		1	Standard Output 15	Standard Output 14	Standard Output 13	Standard Output 12	Standard Output 11	Standard Output 10	Standard Output 9	Standard Output 8
1791DS-IB8XOBV4, 1732-IB8XOBV4	234	0	Safety Output 7	Safety Output 6	Safety Output 5	Safety Output 4	Safety Output 3	Safety Output 2	Safety Output 1	Safety Output 0
1791DS-IB8XOBV4, 1732-IB8XOBV4	2C4	0	Safety Output 7	Safety Output 6	Safety Output 5	Safety Output 4	Safety Output 3	Safety Output 2	Safety Output 1	Safety Output 0
		1	Standard Output 7	Standard Output 6	Standard Output 5	Standard Output 4	Standard Output 3	Standard Output 2	Standard Output 1	Standard Output 0

Get Point Status from Safety I/O Modules by Using Explicit Messaging

What This Appendix Contains

This appendix provides information about how to use explicit messaging to get point status information from safety I/O modules.

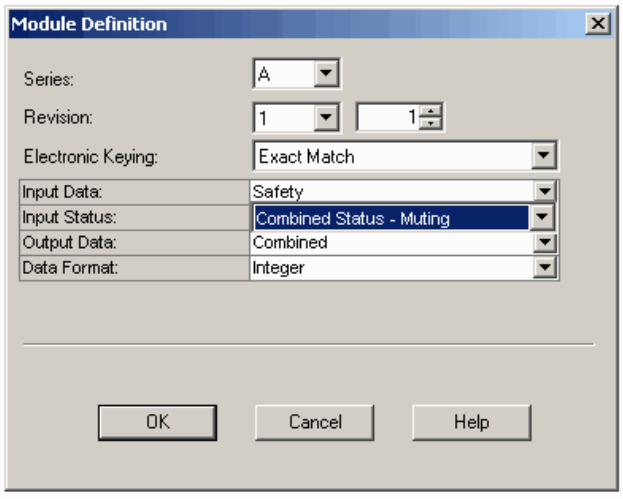
One of the variables in maximizing throughput when using DeviceNet safety I/O modules is the size of the I/O assembly, with the other variables being the requested packet interval and baud rate.

For maximum throughput you need to keep the I/O assembly at two bytes or fewer. The two-byte I/O assemblies do not provide the individual point status needed to quickly diagnose what point faulted from an operator terminal. Read this appendix for a description of how to get the point status via explicit messaging.

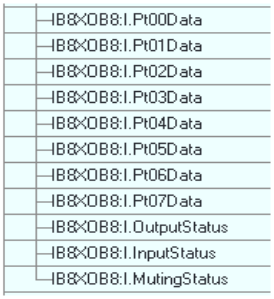
Work with 1791DS-IB8XOB8 Modules

To work with 1791DS-IB8XOB8 modules, follow this procedure.

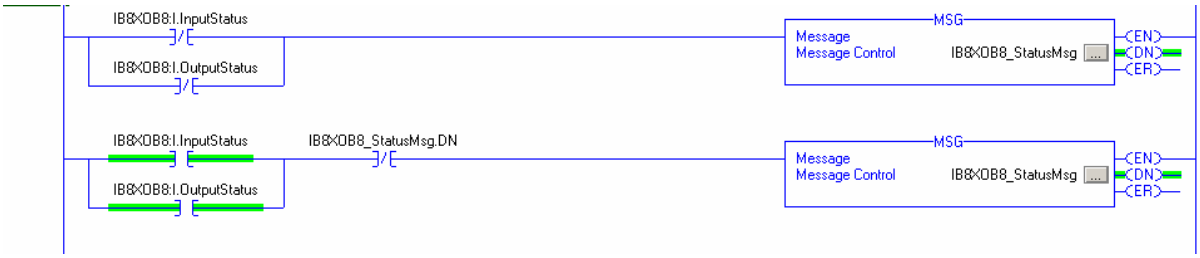
1. From the Module Definition dialog, use Combined Status-Muting for Input Status.



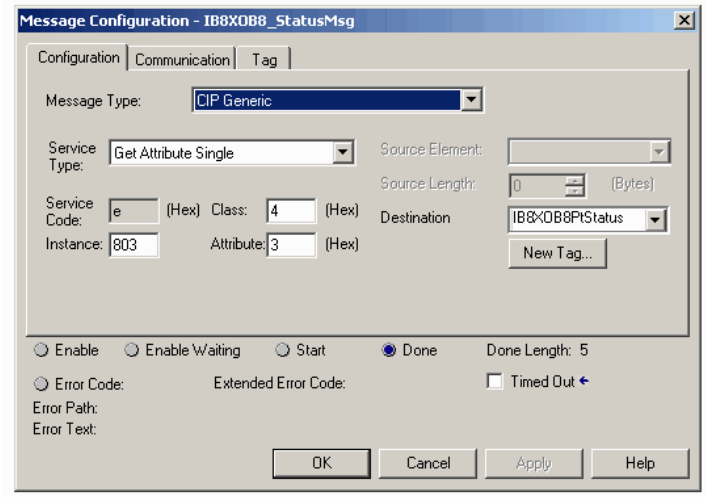
This creates a two-byte input assembly, as shown for a module called IB8XOB8.



2. Use the combined InputStatus and combined OutputStatus bits to detect if one or more of the I/O points on the module have a fault.
   - If either InputStatus or OutputStatus bit goes low (l0 = bad; 1 = good), use an explicit message to determine which individual data points have faulted.
   - Use the InputStatus and OutputStatus bits to condition your msg rungs as follows.
   - Note that the second rung can be used to read the status on mode transition and once a fault is detected, continue reading until the fault is corrected.



See the figure that shows 1791DS-IB8XOB8 message instruction parameters.



Note that we created a UDT for the destination type.

- You can find the UDT called Assembly803_1791DS_IB8XOB8 in an ACD file. This UDT is based on the Assembly803 for 1791DS_IB8XOB8 module.
- There are other assemblies in the EDS file that can be used, but this one is the most inclusive.
- Make sure the Communication Path is set to the correct module.

See the figure that shows 1791DS-IBXOB8 Assembly803 UDT.

Name: Assembly803_1791DS_IB8XOB8

Description: This UDT is for generic msg to 1791DS-IB8XOB8 service type e; Class 4; Instance 803; Attr 3;

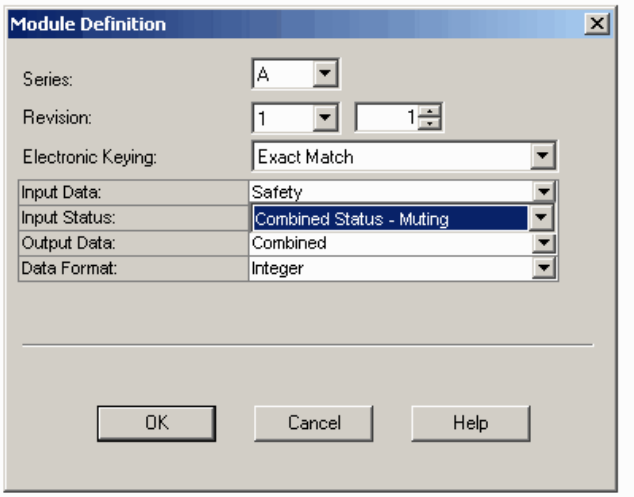
Members: Data Type Size: 8 byte(s)

Name	Data Type	Style	Description
Reserved0	BOOL	Decimal	Do Not Use
Reserved1	BOOL	Decimal	Do Not Use
Reserved2	BOOL	Decimal	Do Not Use
Reserved3	BOOL	Decimal	Do Not Use
Reserved4	BOOL	Decimal	Do Not Use
Reserved5	BOOL	Decimal	Do Not Use
Reserved6	BOOL	Decimal	Do Not Use
Reserved7	BOOL	Decimal	Do Not Use
Safety_Input0_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Input1_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Input2_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Input3_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Input4_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Input5_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Input6_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Input7_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Output0_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Output1_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Output2_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Output3_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Output4_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Output5_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Output6_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Output7_Status	BOOL	Decimal	1 = good 0 = bad
Readback0	BOOL	Decimal	1 = 24v at the output terminal
Readback1	BOOL	Decimal	1 = 24v at the output terminal
Readback2	BOOL	Decimal	1 = 24v at the output terminal
Readback3	BOOL	Decimal	1 = 24v at the output terminal
Readback4	BOOL	Decimal	1 = 24v at the output terminal
Readback5	BOOL	Decimal	1 = 24v at the output terminal
Readback6	BOOL	Decimal	1 = 24v at the output terminal
Readback7	BOOL	Decimal	1 = 24v at the output terminal
TestOutput0_Status	BOOL	Decimal	1 = good 0 = bad
TestOutput1_Status	BOOL	Decimal	1 = good 0 = bad
TestOutput2_Status	BOOL	Decimal	1 = good 0 = bad
TestOutput3_Status	BOOL	Decimal	1 = good 0 = bad
Reserved8	BOOL	Decimal	Not used
Reserved9	BOOL	Decimal	Not used
Reserved10	BOOL	Decimal	Not used
MutingLamp_Status	BOOL	Decimal	1 = good 0 = bad

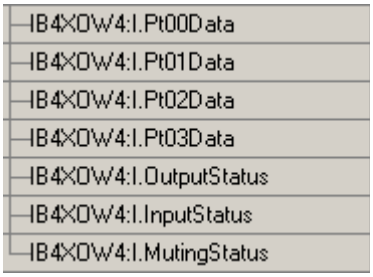
Work with 1791DS-IB4XOW4 Modules

To work with 1791DS-IB4XOW4 modules, follow this procedure.

1. From the Module Definition dialog, use Combined Status-Muting for the Input Status.

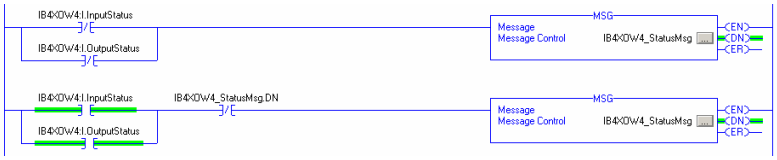


This creates a one-byte assembly, as shown in the figure, for a module called IB4XOW4.

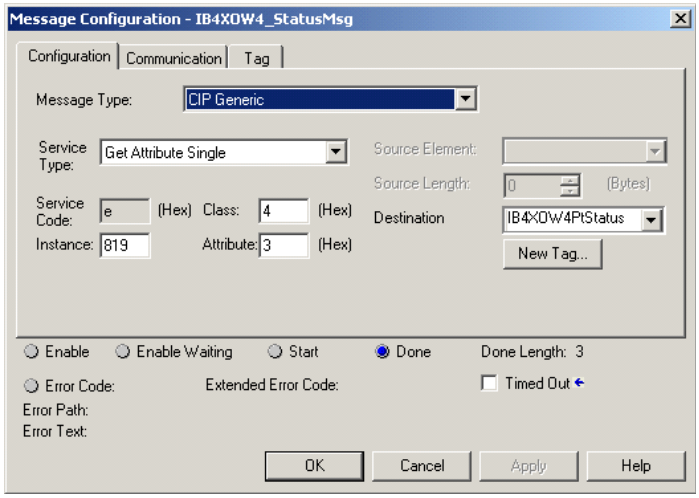


2. Use the combined InputStatus and combined OutputStatus bits to detect if one or more of the I/O points on the module have a fault.
   - If either InputStatus or OutputStatus bit goes low (0 = bad; 1 = good) use an explicit message to determine which individual data points have faulted.
   - Use the InputStatus and OutputStatus bits to condition your msg rungs as shown in the figure.

- Note that the second rung can be used to read the status on mode transition and once a fault is detected, continue reading until the fault is corrected.



See the figure that shows 1791DS-IB4XXOW4 message instruction parameters.



Note that we created a UDT for the destination type.

- You can find the UDT call Assembly819_1791DS_IB4XOW4 in the ACD file. This UDT is based on Assembly819 for 1791DS_IB4XOW4 module.
- There are other assemblies in the EDS file that can be used, but this one is the most inclusive.
- Make sure the communication path is set to the correct module.

See the figure that shows 1791DS-IB4XOW4 Assembly819 UDT.

Name: Assembly819_1791DS_IB4XOW4

Description: This UDT is for generic msg to 1791DS-IB4XOW4 service type e; Class 4; Instance 819; Attr 3;

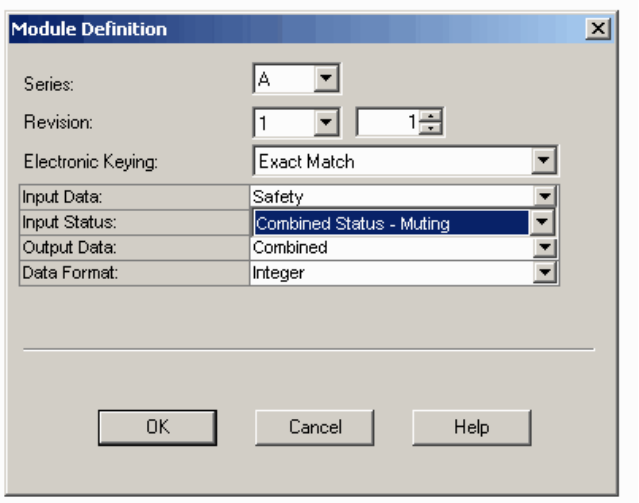
Members: Data Type Size: 4 byte(s)

Name	Data Type	Style	Description
Reserved0	BOOL	Decimal	Do Not Use
Reserved1	BOOL	Decimal	Do Not Use
Reserved2	BOOL	Decimal	Do Not Use
Reserved3	BOOL	Decimal	Do Not Use
Safety_Input0_Status	BOOL	Decimal	1 good 0 bad
Safety_Input1_Status	BOOL	Decimal	1 good 0 bad
Safety_Input2_Status	BOOL	Decimal	1 good 0 bad
Safety_Input3_Status	BOOL	Decimal	1 good 0 bad
Safety_Output0_Status	BOOL	Decimal	1 good 0 bad
Safety_Output1_Status	BOOL	Decimal	1 good 0 bad
Safety_Output2_Status	BOOL	Decimal	1 good 0 bad
Safety_Output3_Status	BOOL	Decimal	1 good 0 bad
Output0_Readback	BOOL	Decimal	1 = 24v at the terminal point
Output1_Readback	BOOL	Decimal	1 = 24v at the terminal point
Output2_Readback	BOOL	Decimal	1 = 24v at the terminal point
Output3_Readback	BOOL	Decimal	1 = 24v at the terminal point
TestOutput0_Status	BOOL	Decimal	1 = good 0 = bad
TestOutput1_Status	BOOL	Decimal	1 = good 0 = bad
TestOutput2_Status	BOOL	Decimal	1 = good 0 = bad
TestOutput3_Status	BOOL	Decimal	1 = good 0 = bad
Reserved4	BOOL	Decimal	Not used
Reserved5	BOOL	Decimal	Not used
Reserved6	BOOL	Decimal	Not used
MutingLamp_Status	BOOL	Decimal	1 = good 0 = bad

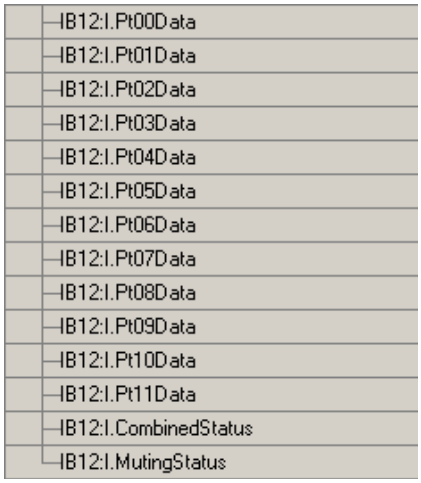
Work with 1791DS-IB12 Modules

To work with 1791DS-IB12 modules, follow this procedure.

1. From the Module Definition dialog, use Combined Status-Muting for the Input Status.

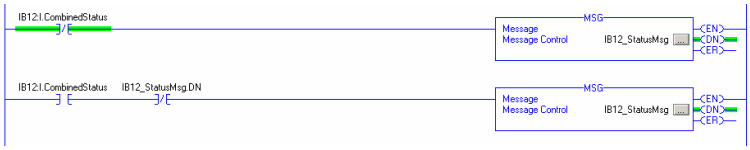


   This creates a two-byte input assembly, as shown in the figure, for a module called IB12.

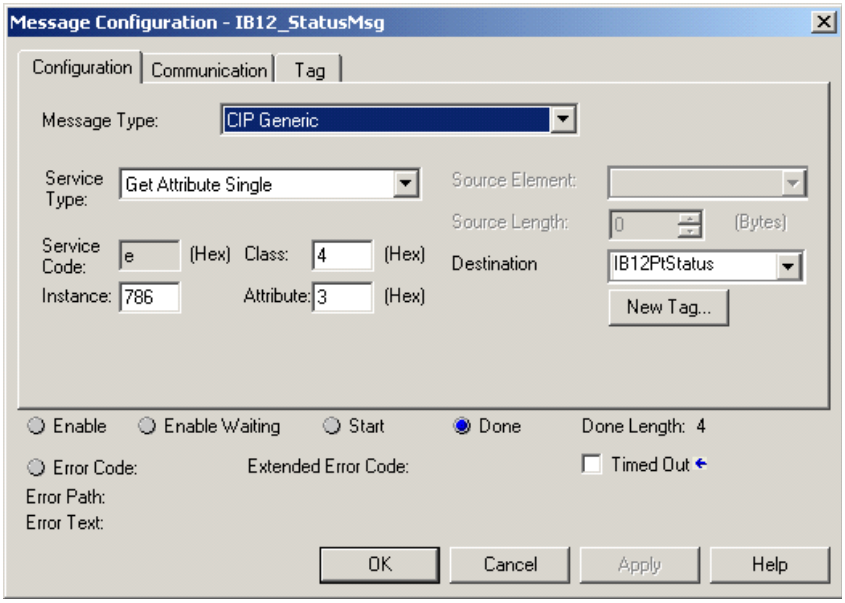


2. Use the CombinedStatus bit to detect if one or more of the I/O points on the module have a fault.
   - If the CombinedStatus bit goes low (0 = bad; 1 = good) use an explicit message to determine which individual data points have faulted.
   - Use the CombinedStatus bits to condition your msg rungs as shown in the figure.

- Note that you can use the second rung to read the status on mode transition and once a fault is detected, continue reading until the fault is corrected.



See the figure that shows 1791DS-IB12 message instruction parameters.



Note that we created a UDT for the destination type.

- You can find the UDT called Assembly786_1791DS_IB12 in the ACD file. This UDT is based on Assembly786 for the 1791DS_IB12 module.
- There are other assemblies in the EDS file that can be used but this one is the most inclusive.
- Make sure the Communication Path is set to the correct module.

See the figure that shows the 1791DS-IB12 Assembly786 UDT.

Name: Assembly786_1791DS_IB12

Description: This UDT is for generic msg to 1791DS-IB12 service type e; Class 4; Instance 786; Attr 3;

Members: Data Type Size: 4 byte(s)

Name	Data Type	Style	Description
Reserved0	BOOL	Decimal	Do Not Use
Reserved1	BOOL	Decimal	Don Not Use
Reserved2	BOOL	Decimal	Do Not Use
Reserved3	BOOL	Decimal	Do Not Use
Reserved4	BOOL	Decimal	Do Not Use
Reserved5	BOOL	Decimal	Do Not Use
Reserved6	BOOL	Decimal	Do Not Use
Reserved7	BOOL	Decimal	Do Not Use
Reserved8	BOOL	Decimal	Do Not Use
Reserved9	BOOL	Decimal	Do Not Use
Reserved10	BOOL	Decimal	Do Not Use
Reserved11	BOOL	Decimal	Do Not Use
Safety_Input0_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Input1_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Input2_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Input3_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Input4_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Input5_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Input6_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Input7_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Input8_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Input9_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Input10_Status	BOOL	Decimal	1 = good 0 = bad
Safety_Input11_Status	BOOL	Decimal	1 = good 0 = bad
TestOutput0_Status	BOOL	Decimal	1 = good 0 = bad
TestOutput1_Status	BOOL	Decimal	1 = good 0 = bad
TestOutput2_Status	BOOL	Decimal	1 = good 0 = bad
TestOutput3_Status	BOOL	Decimal	1 = good 0 = bad
Reserved12	BOOL	Decimal	Not used
Reserved13	BOOL	Decimal	Not used
Reserved14	BOOL	Decimal	Not used
MutingLamp_Status	BOOL	Decimal	1 = good 0 = bad

Create SmartGuard 600 Code: An Example

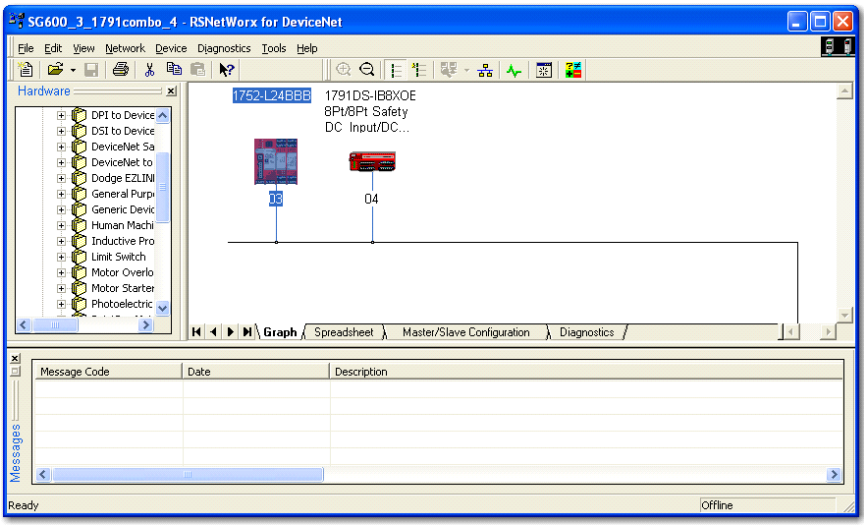
What This Appendix Contains

This appendix provides sample SmartGuard application code. Read this appendix for information about how to create SmartGuard 600 code on a 1791DS-IB8XOB8 module. This code monitors a light curtain and emergency stop button to control dual safety contactors with feedback, per the following table.

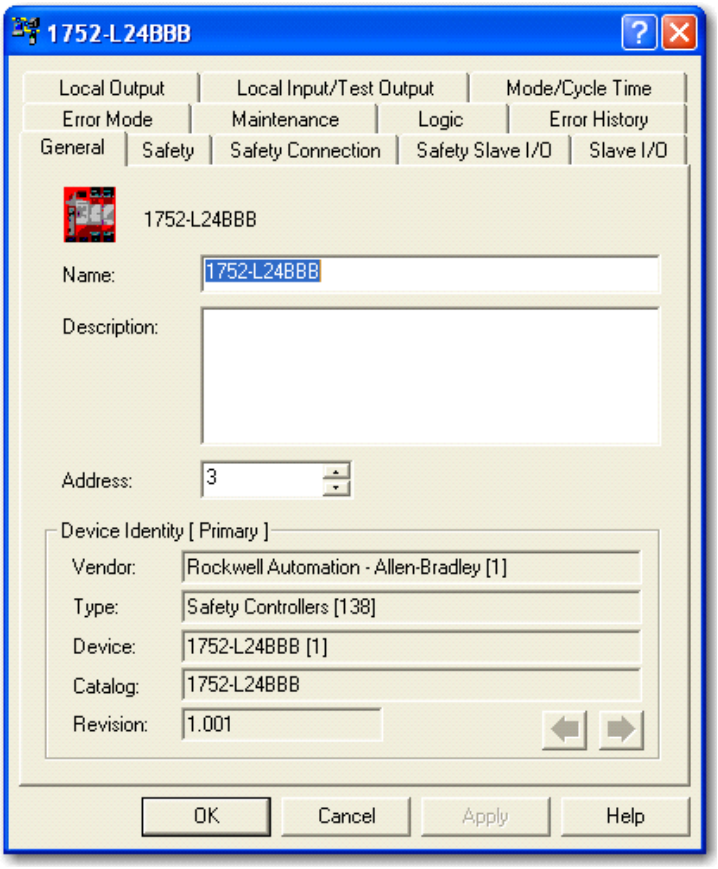
SmartGuard 600 Code

Code	Input/Output
Estop_chA	Input 0 (pulse tested by T0)
Estop_chB	Input 1 (pulse tested by T1)
LC_chA	Input 2
LC_chB	Input 3
Reset PB	Input 4
Feedback	Input 5
Contactor_A	Output 0
Contactor_B	Output 1

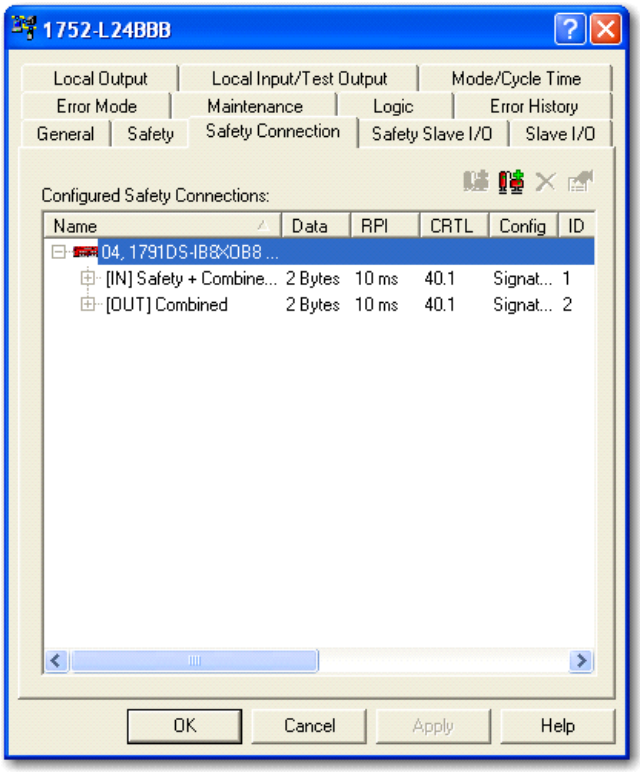
1. Start RSNetWorx for DeviceNet software and open a project with a SmartGuard controller and 1791DS module, referring to Configure a SmartGuard Controller in this chapter, if needed.



2. Double-click the SmartGuard controller to bring up the 1752-L24BBB dialog.



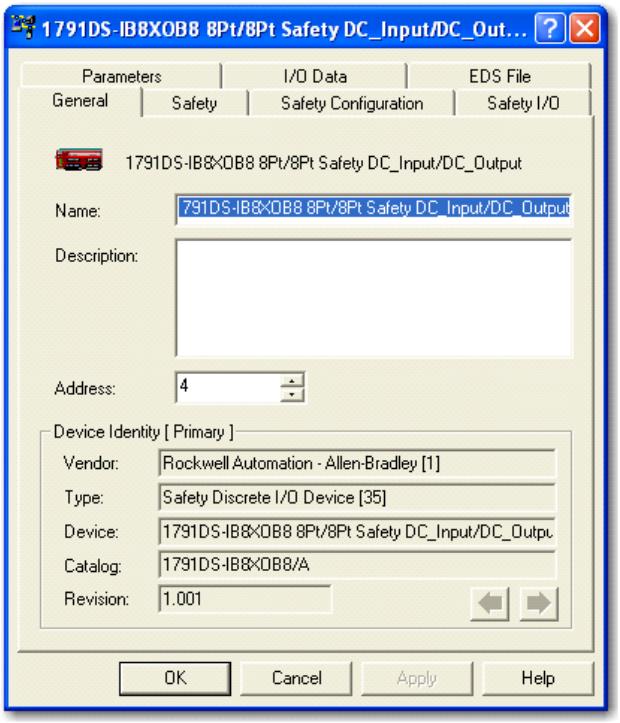
3. From the top of the 1752-L24BBB dialog, click Safety Connection.



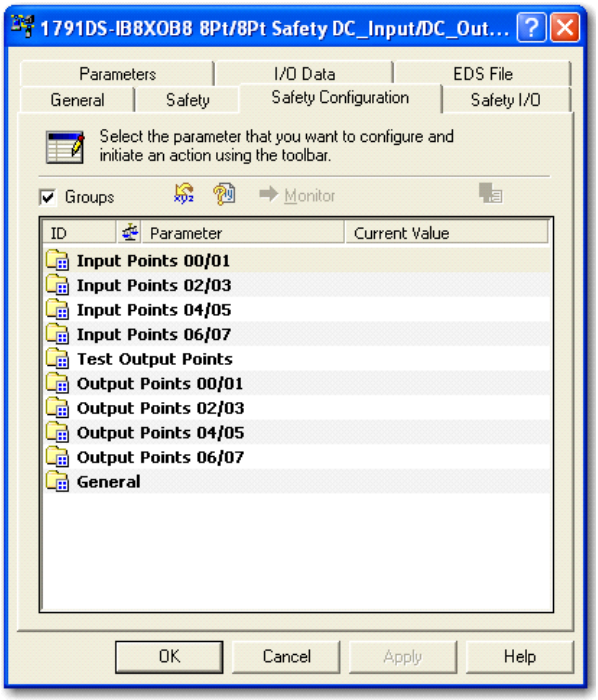
4. Verify that you have a project with input and output connections to a 1791DS-IB8XOB8 module, referring to Configure a SmartGuard Controller in this chapter, if needed, to create these connections.

5. From the 1752-L24BBB dialog, click Cancel.

6. Double-click 1791DS module to see its properties dialog.

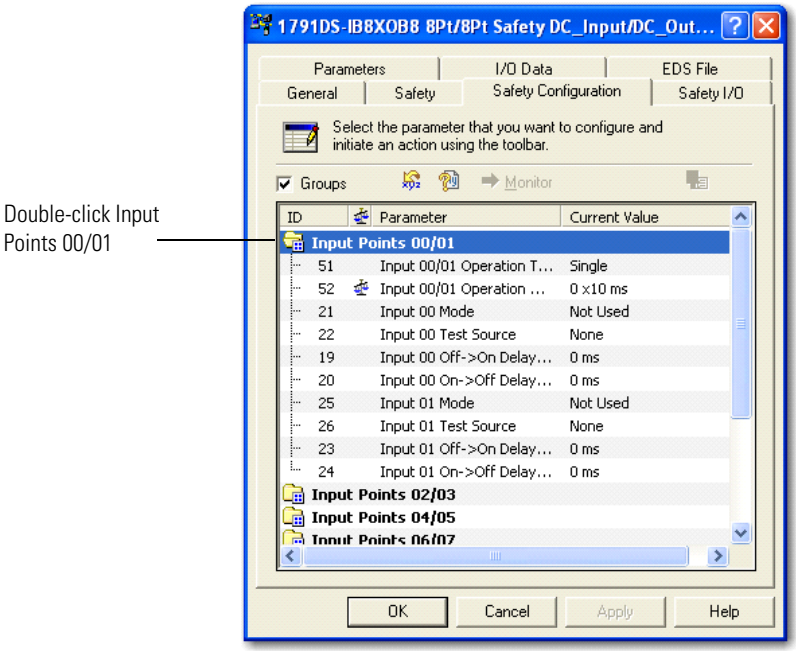


7. From the top of the dialog, click Safety Configuration.

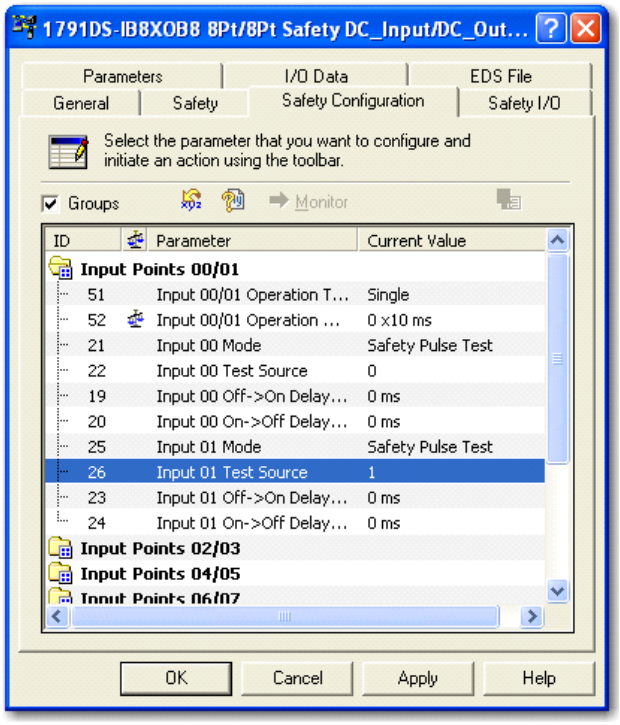


8. From the dialog, perform this procedure.

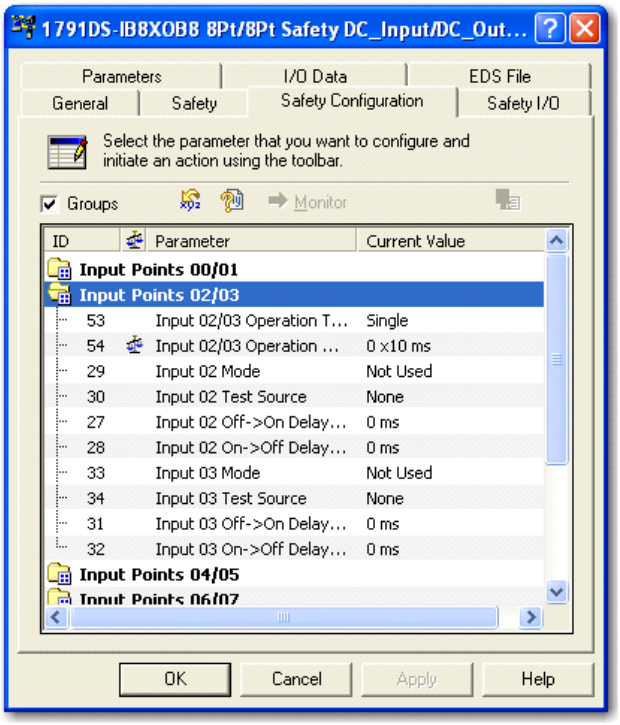
a. Double-click Input Points 00/01, noting that inputs 00 and 01 are the Estop pushbuttons.



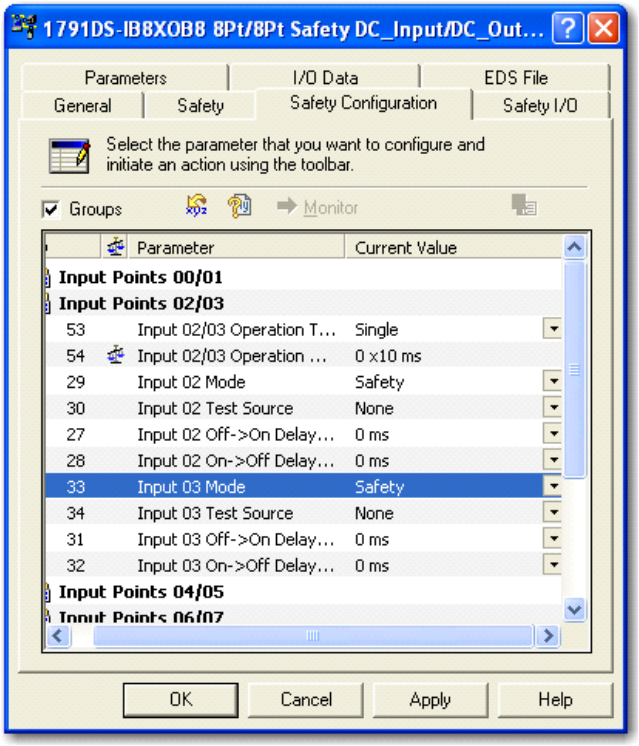
b. Edit the parameters so that the channels are pulse tested by Test sources 0 and 1, respectively.



c. Double-click Input Points 00/01 to minimize and Input Points 02/03 to expand, noting the following.

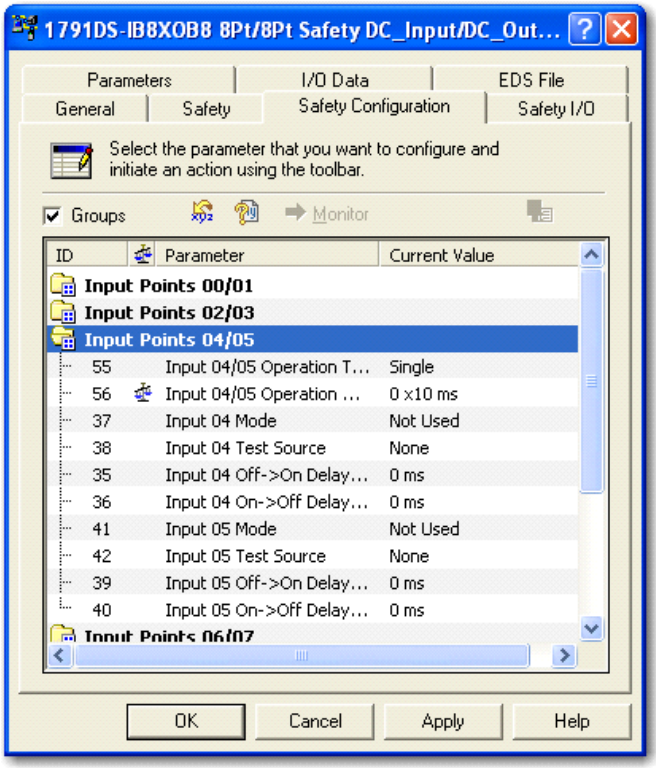


- The light curtain is connected to inputs 02 and 03.
- The GuardShield pulse tests OSSD1 and OSSD2, so these inputs will be configured as Safety Inputs.



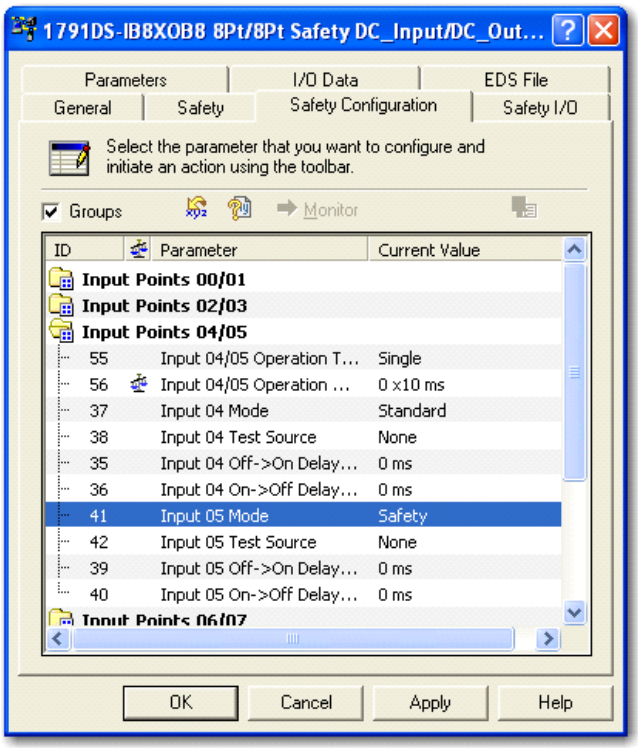
d. Double-click Input Points 02/03 to minimize.

e. Double-click Input Points 04/05 to expand.



f. Add the reset button to input 04, making it a standard input as it is not required to be a safety input.

g. Add the AUX feedback circuit for the redundant safety contactors to input 05, making it a safety input as it is not being pulse tested.



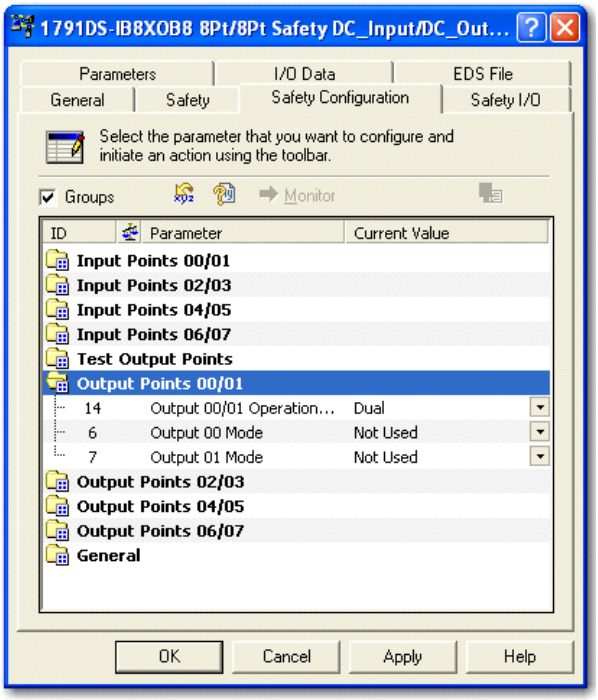
h. Double-click Input Points 04/05 to minimize.

9. Double-click Output Points 00/01 to expand and follow the procedure to work with output points.

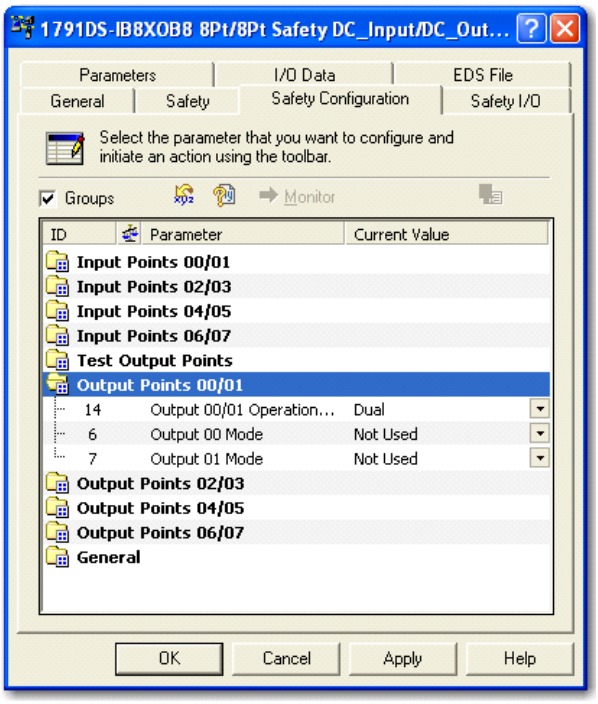
Work with Outputs

Follow this procedure to work with outputs.

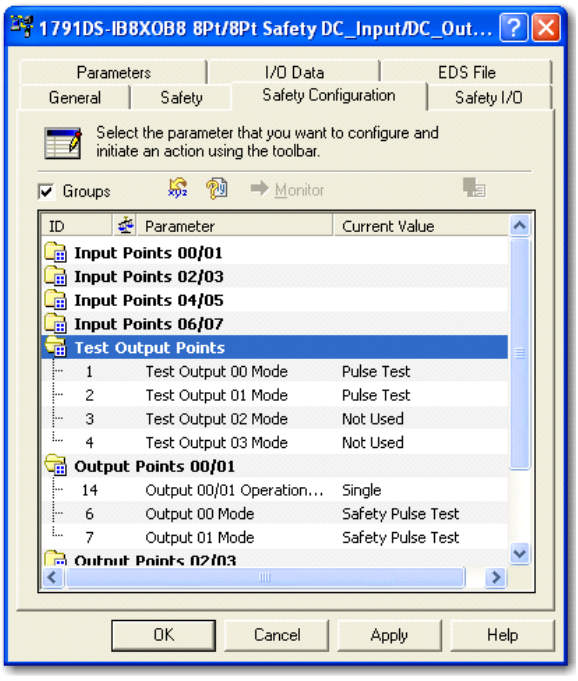
1. Double-click Output Points 00/01 to expand, noting that safety contactors are connected to outputs 00 and 01.



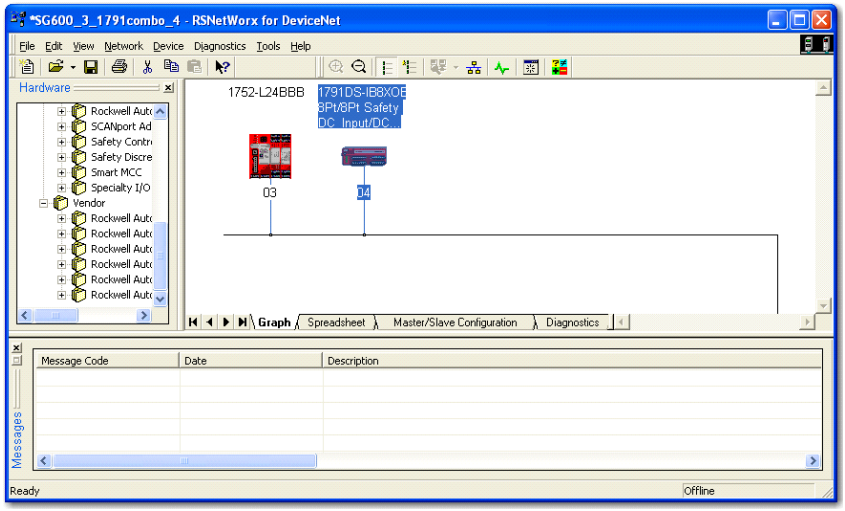
2. Configure them as Safety Pulse test.



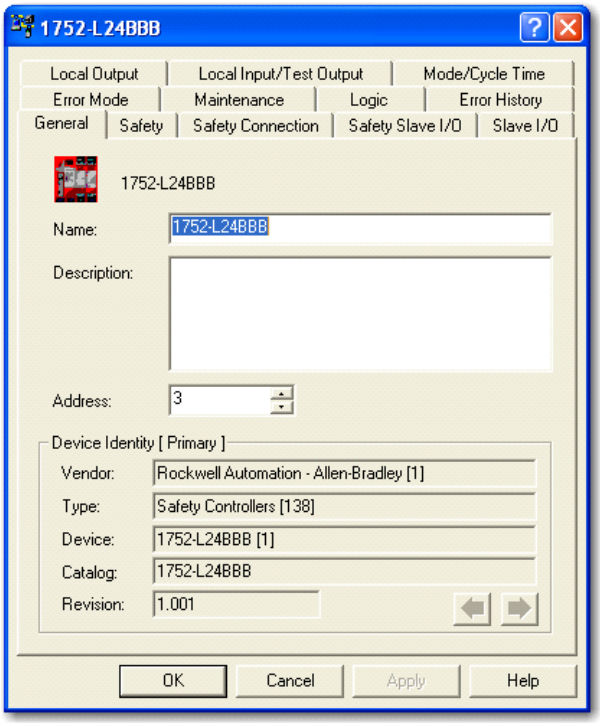
3. Double-click Test Output Points to verify that Test outputs 00 and 01 are configured as test sources to support the EStop pulse testing.



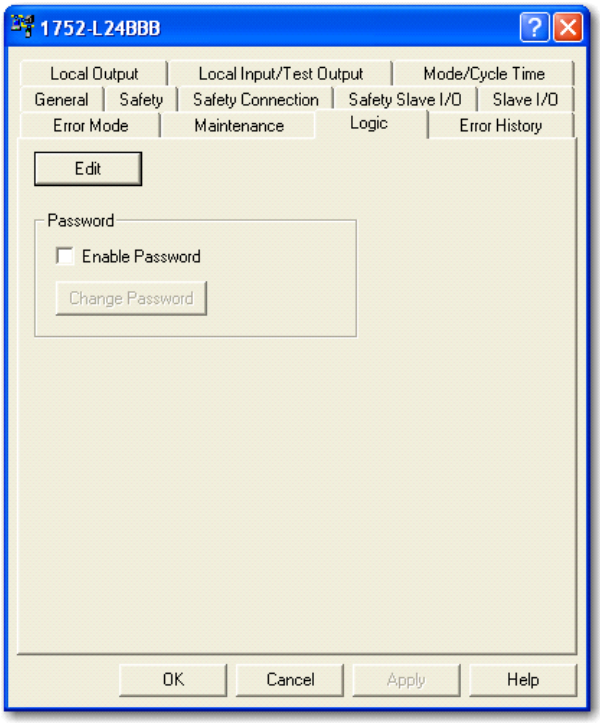
4. Click Apply and OK to return to the main RSNetWorx for DeviceNet dialog.



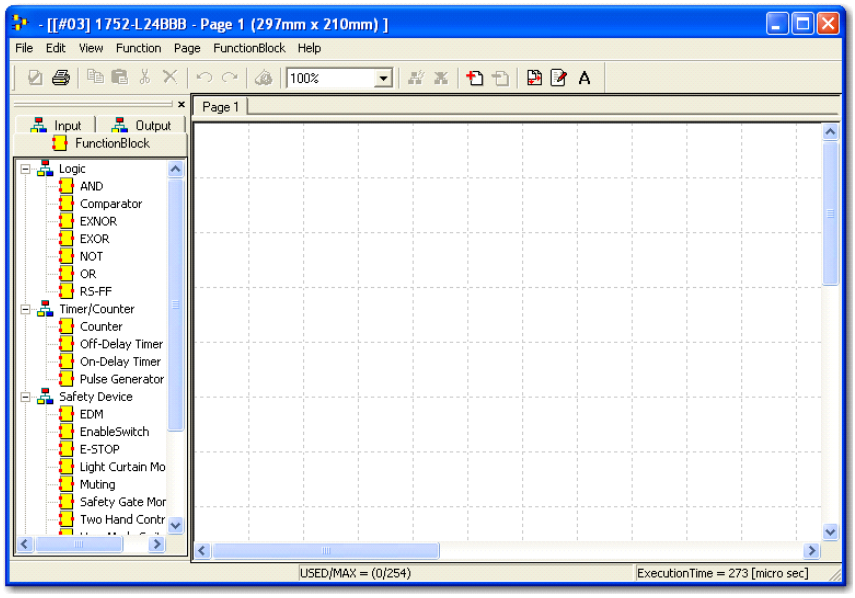
5. Double-click the SmartGuard 600 icon.



6. From the top of the dialog, click Logic.



7. Click Edit to see the SmartGuard editor.

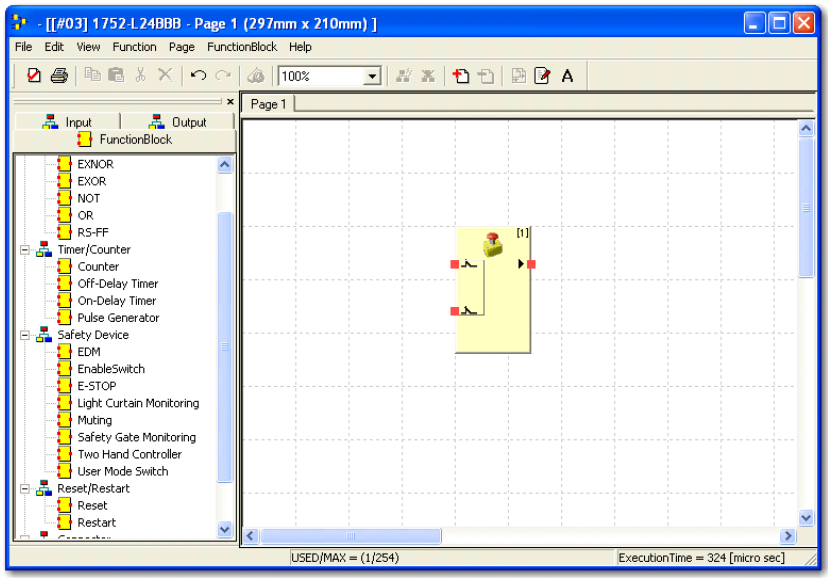


8. Drag over the EStop block and follow the procedure for working with the SmartGuard editor.

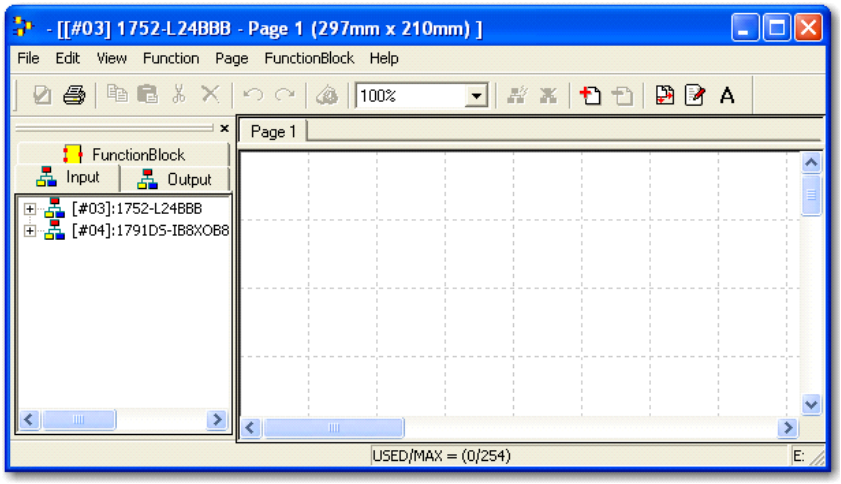
Work with the SmartGuard Editor

Use this procedure as an example of how to work with the SmartGuard editor.

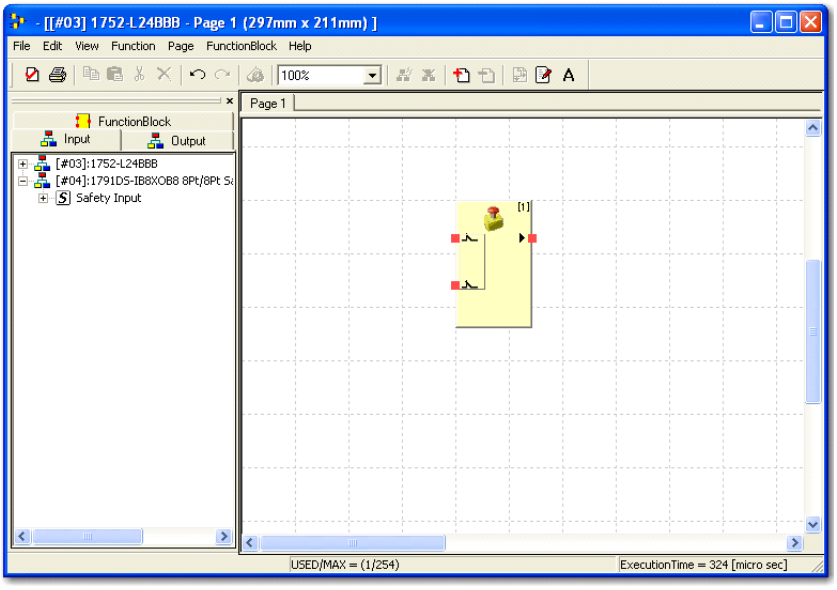
1. Drag over the Estop block .
2. Click the Estop block, hold, and drag and drop onto the dialog.



3. Connect the inputs to the Estop.
4. Click Input.

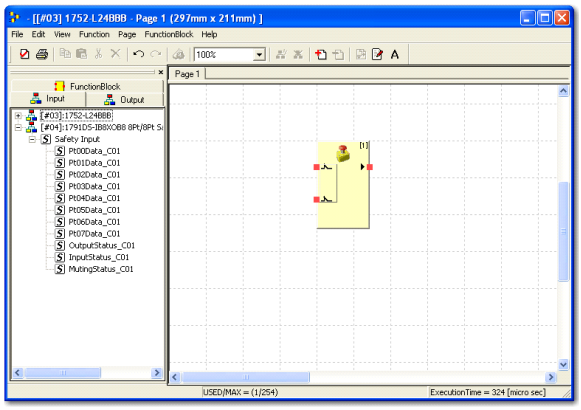


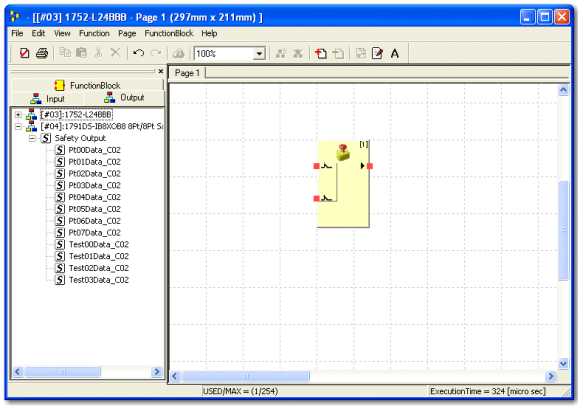
5. Expand the 1791DS-IB8XOB8 module.



6. Expand the Safety Input dialog.

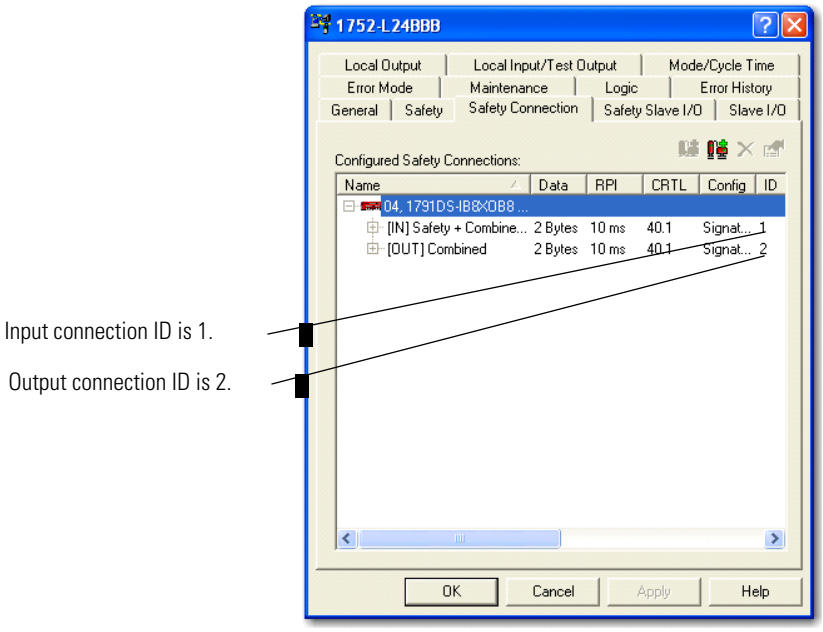
7. Do the same for the outputs, noting the following:
   - Inputs are Pt0xData_C01.
   - Outputs are Pt0xData_C02.
   - C01 stands for safety connection 1.
   - C02 stands for safety connection 2.





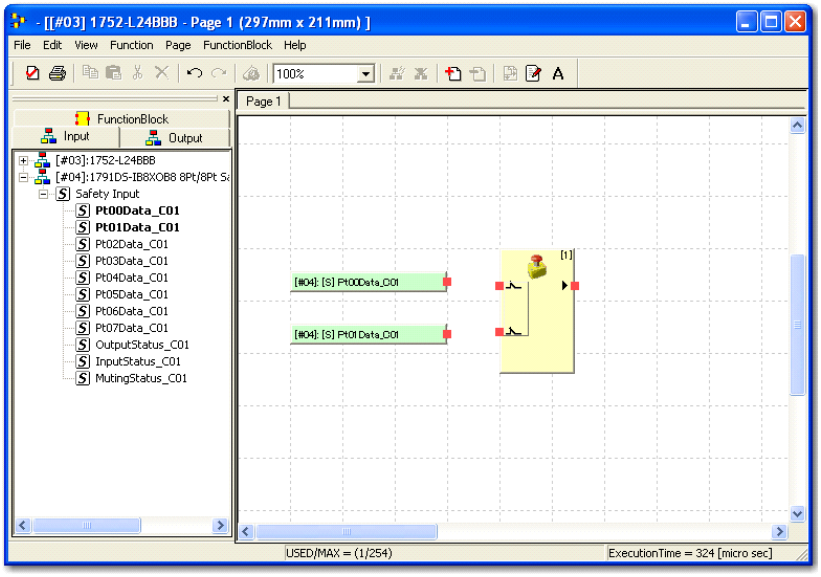
8. Recall when the safety connections were added to the SmartGuard controller, noticing the following:

- Input connection ID is 1.
- Output connection ID is 2.

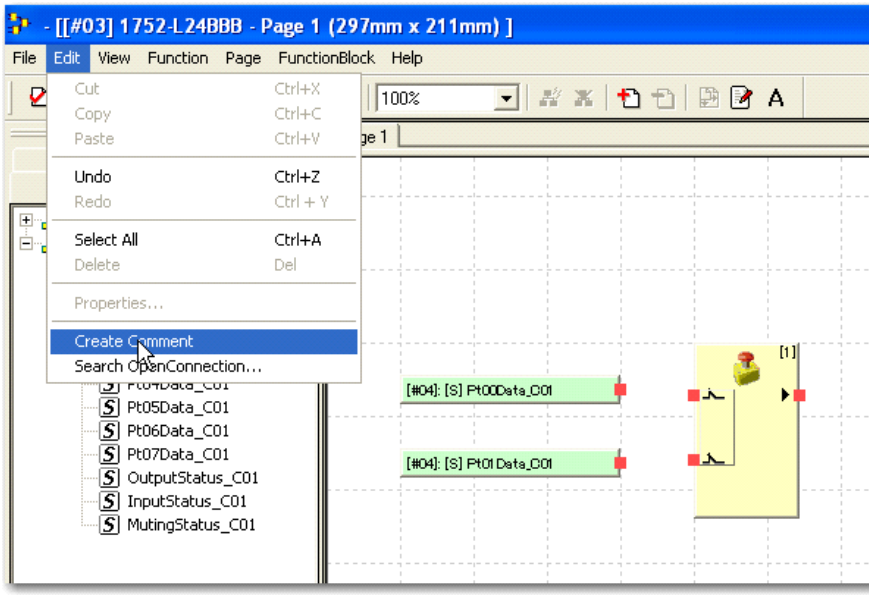


- C01 is safety connection 1, mapping to the safety inputs of node 4.
- C02 is safety connection 2, mapping to the safety outputs of node 4.

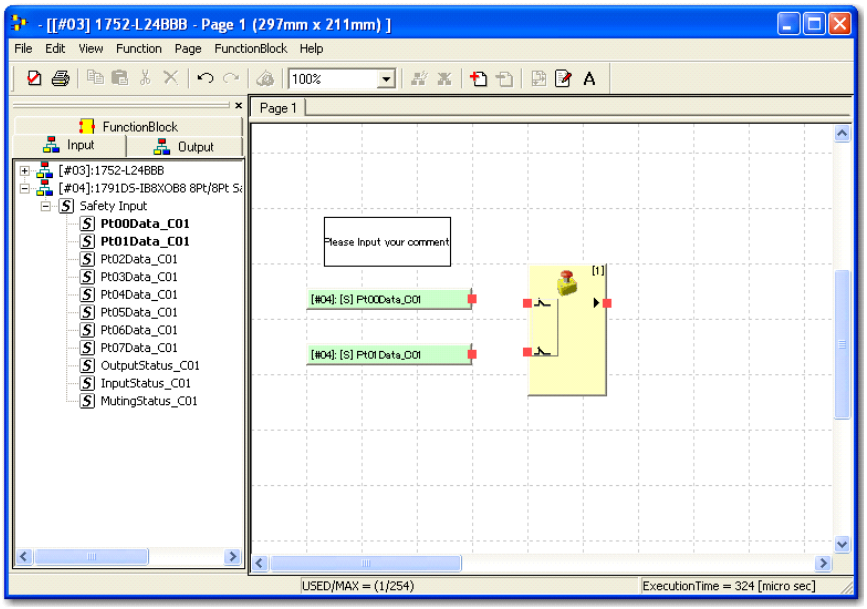
9. Drag inputs 00 and 01 onto the dialog, noting that given generic tagname, you can add comments by following these procedure.



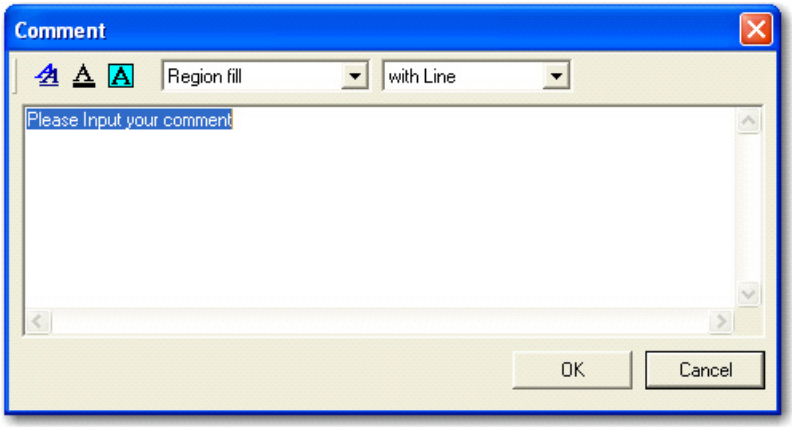
a. Click Edit and Create Comment.



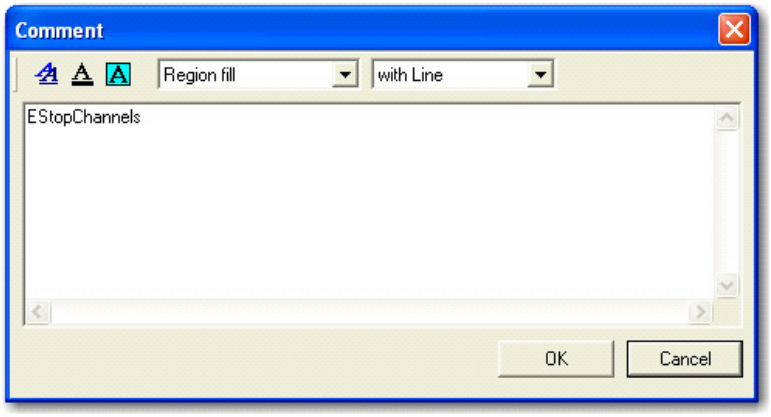
b. Click the editor dialog, hold, and drag to outline the comment box.



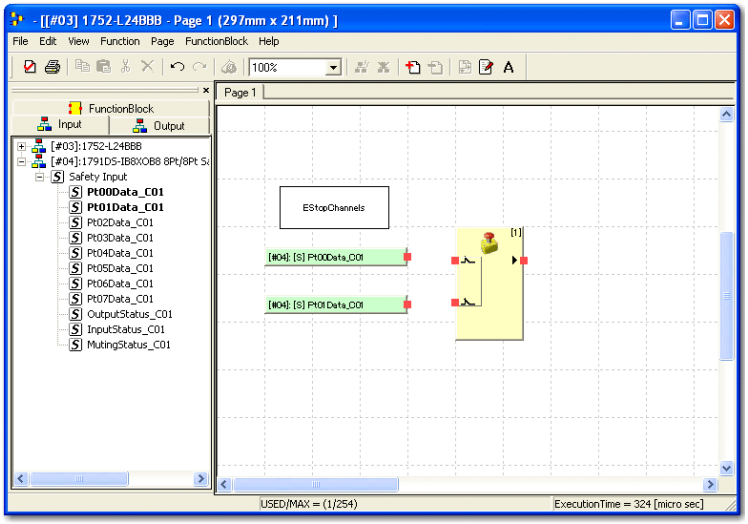
c. Double-click on the comment box.



d. Enter the comment text.

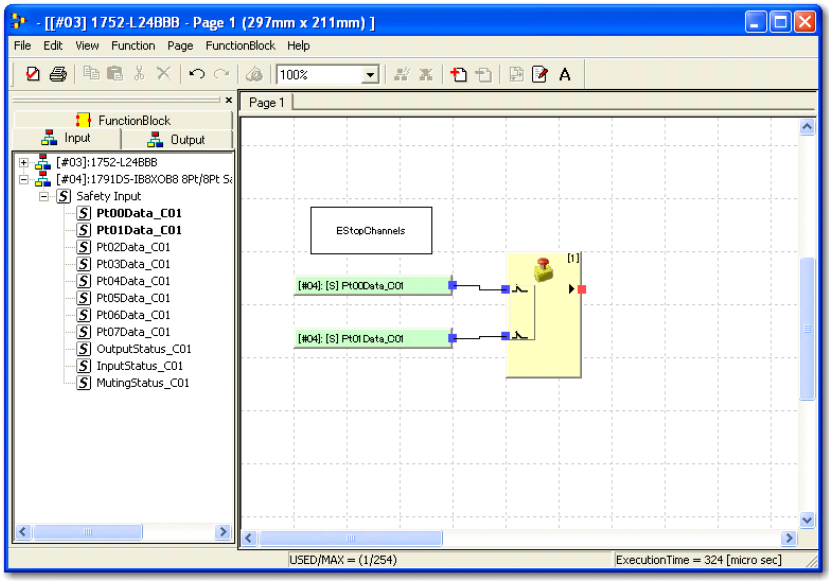


e. Click OK and click the dialog.

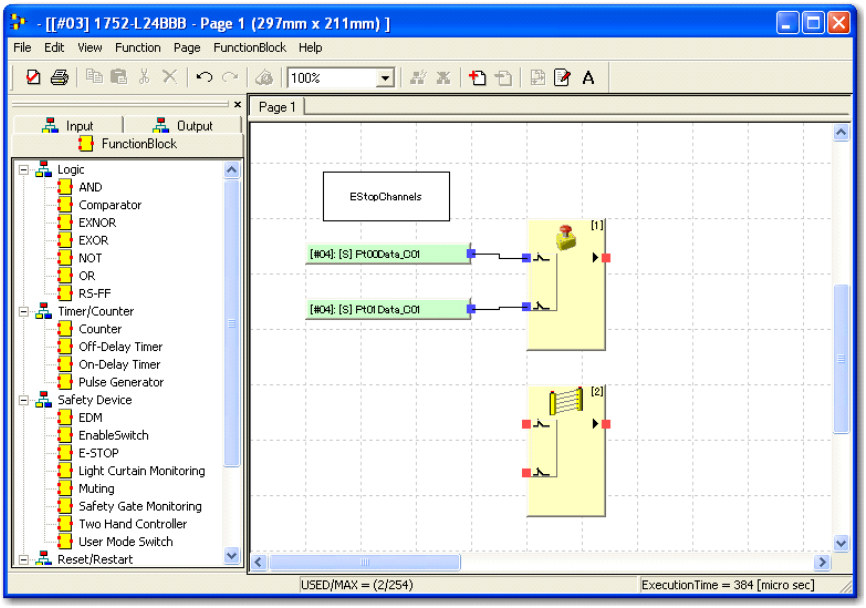


10. Connect the inputs to the Estop block.

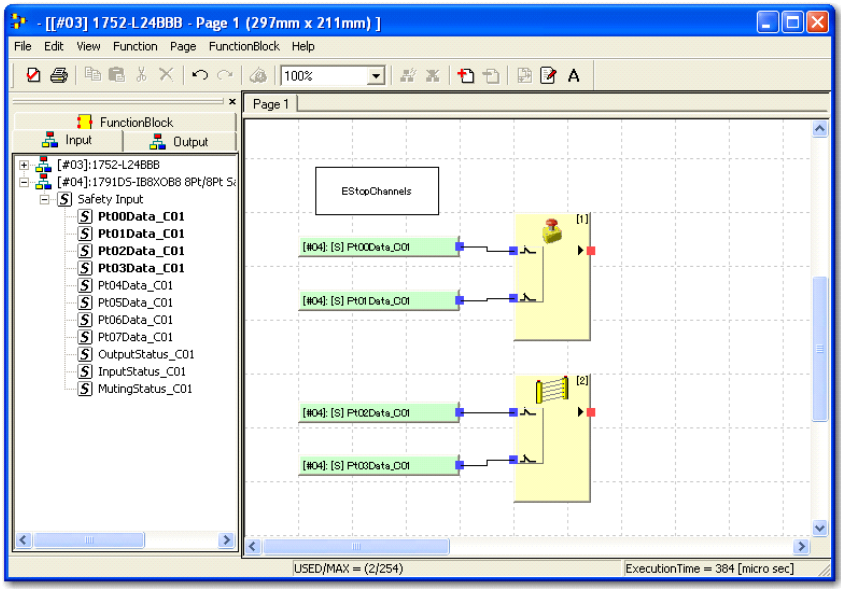
a. Click on the input red blocks, drag, hold, and drop onto Estop block.



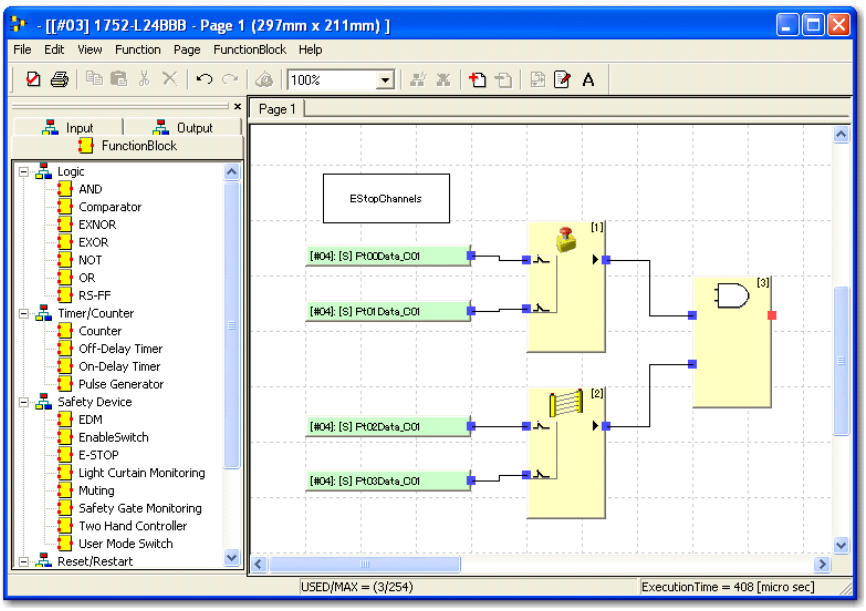
b. Click Function Block and drag a Light Curtain Mounitoring block onto the dialog.



c. Add the light curtain (LC) input channels and connect them to the block.



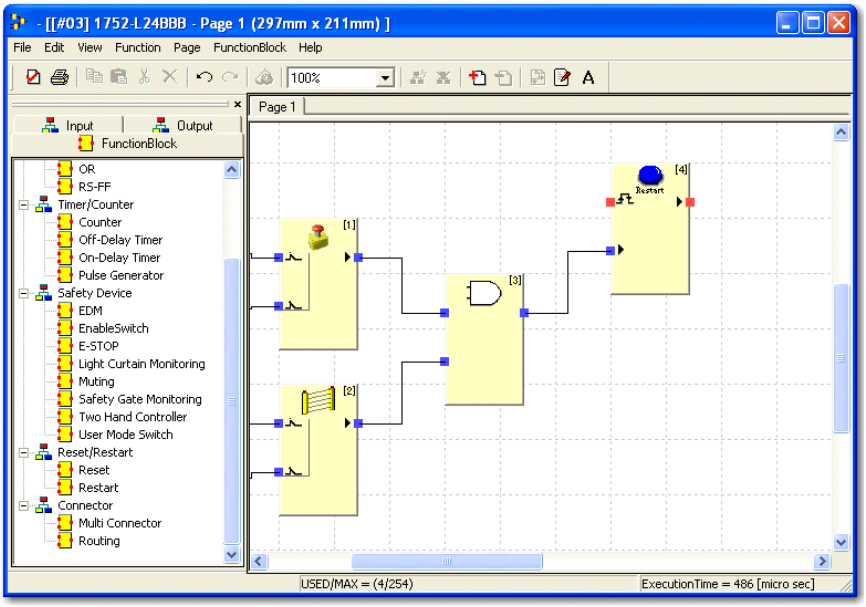
11. Add an AND block to the dialog, and connect the outputs of the Estop and LC blocks to its inputs.



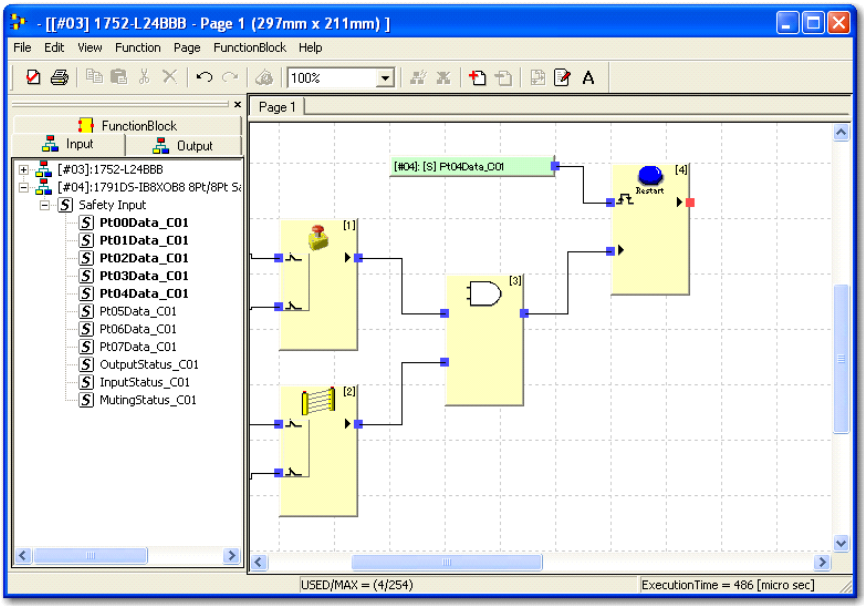
a. Add a Restart block to the dialog.

This forces a Low to High on the reset button to turn on the outputs.

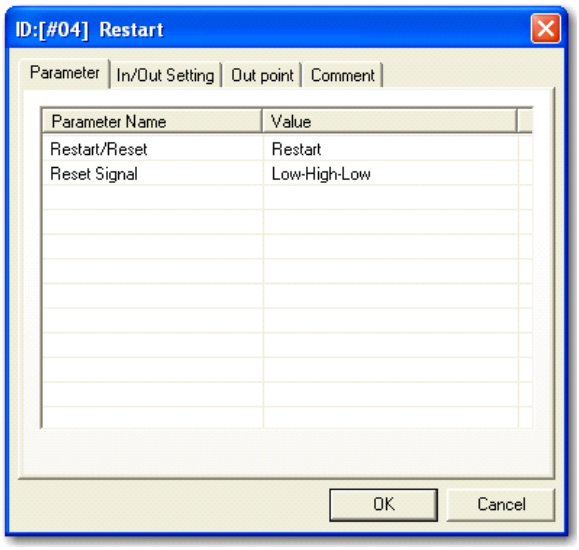
b. Connect the output of the AND to the monitored (lower) input on the Restart.



c. Drag the Reset input onto the dialog, and connect it to the restart (top) input of the block.



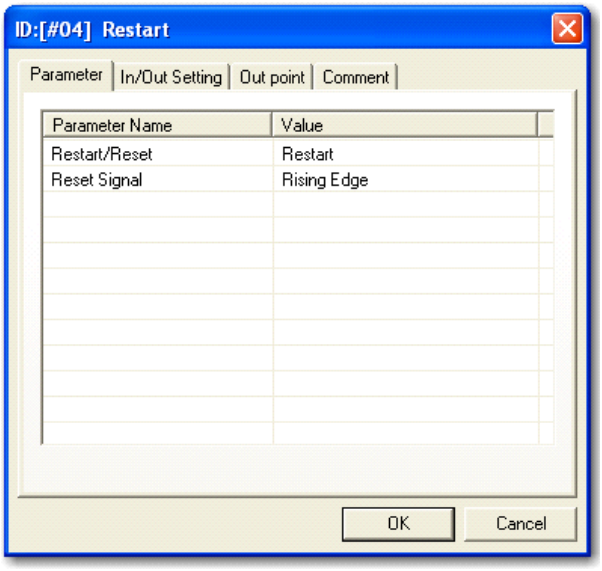
d. Double-click the Restart block.



e. From the dialog, click Low-High-Low and Rising Edge.

Rising edge uses the Low to High transition.

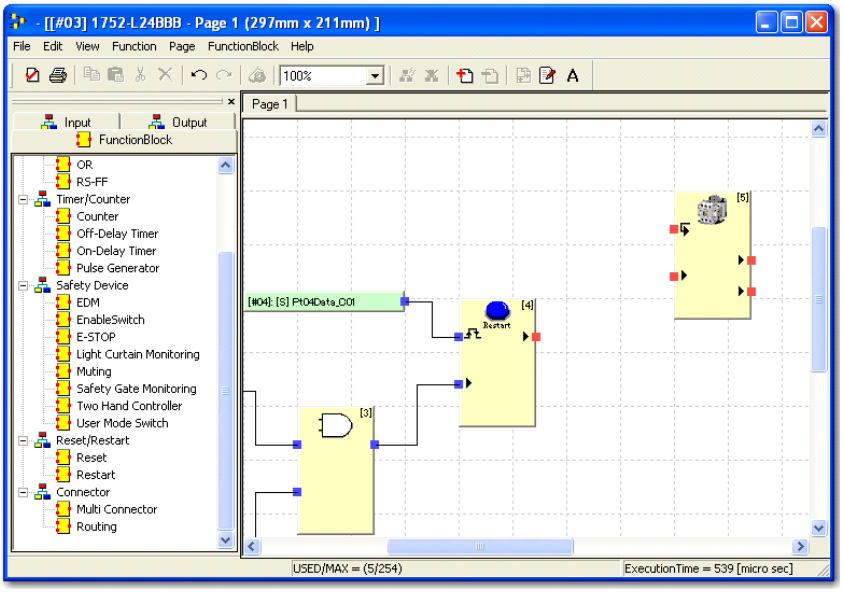
Low-High-Low forces you to release the button, and hold it in for 1 second, approximately.



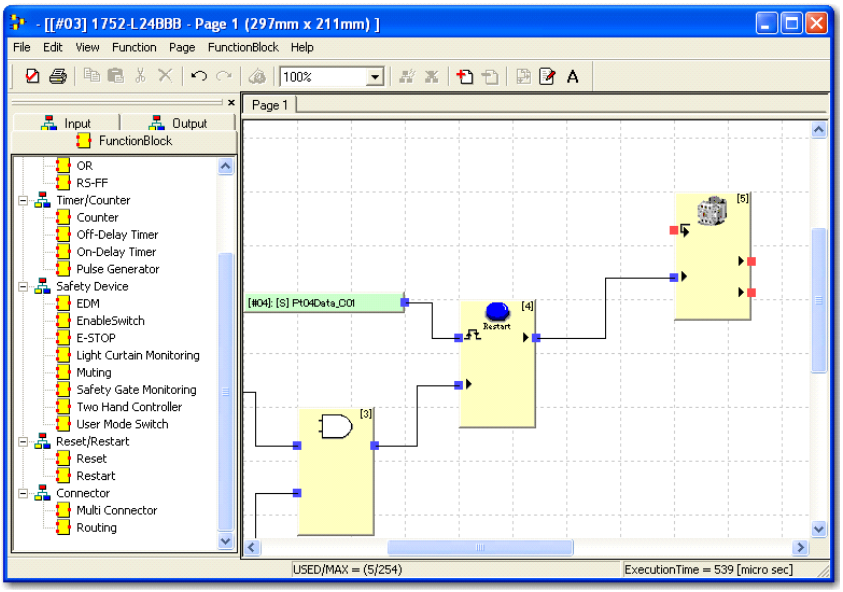
f. Click OK.

12. Drag the EDM (External Device Monitoring) block onto the dialog.

This block controls the dual outputs and monitors for negative feedback.

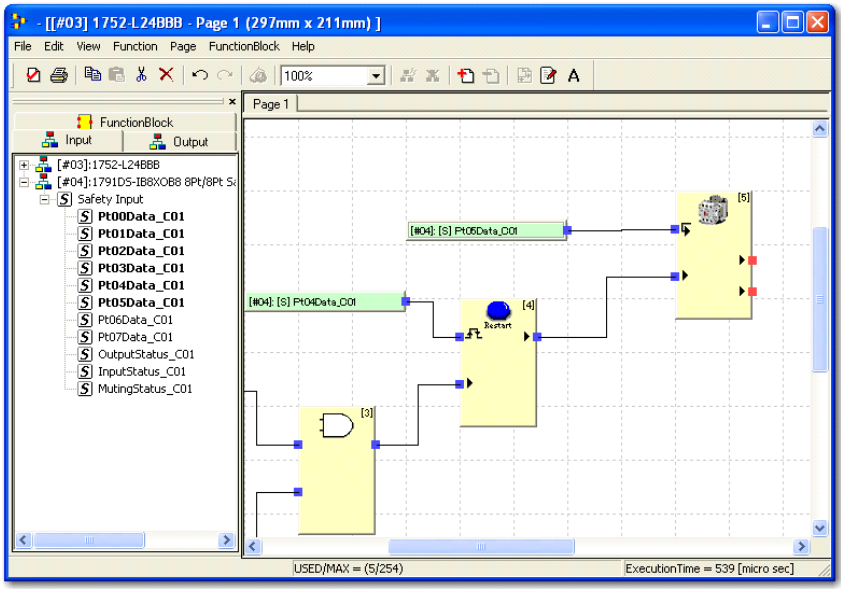


a. Connect the output of the Restart to the Monitored input (lower) of the EDM block.



b. Drag over the Feedback input onto the dialog.

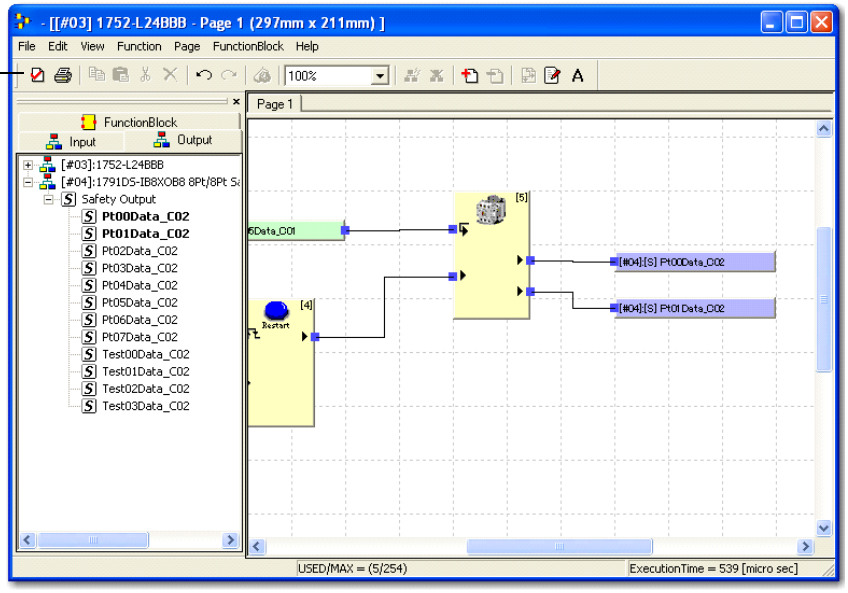
c. Connect it to the EDM FEEDBACK input (top) of the EDM block.



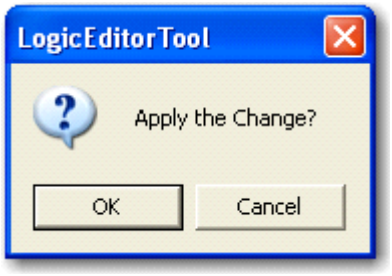
d. Drag the Contactor Outputs onto the dialog, noting they are on the Output dialog under Safety Output under the 1752-L24BBB module.

e. Connect them to the outputs of the EDM block.

Click Apply.

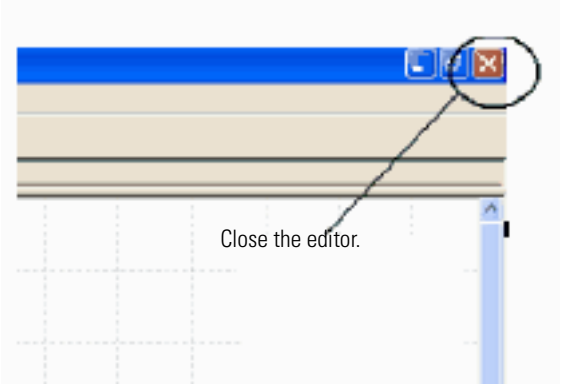


f. Click Apply to see the LogicEditor Tool dialog.



g. From the LogicEditor Tool dialog, click OK.

13. Close the editor.



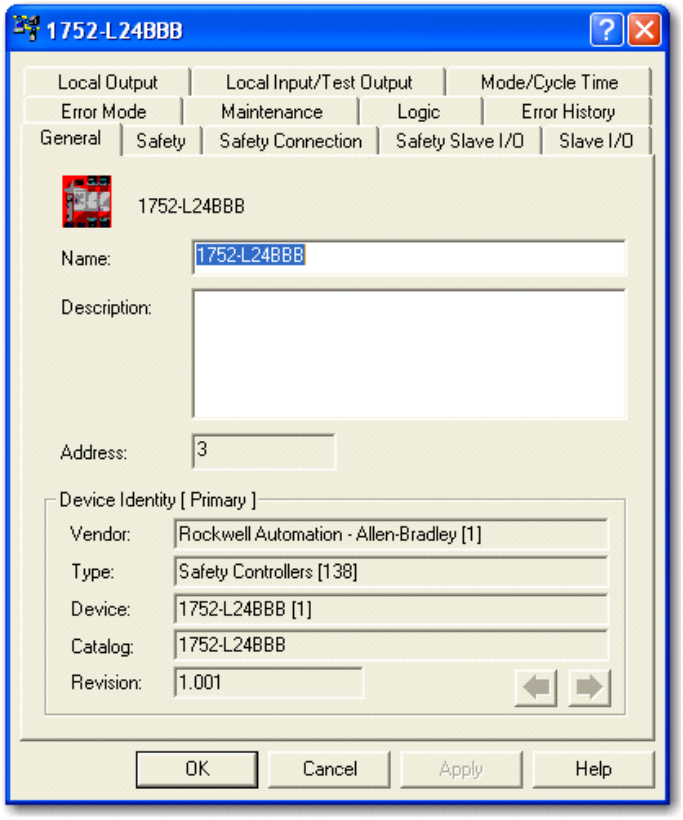
14. From the SmartGuard dialog, click Apply and OK.

15. If online, your program downloads; if offline, you need to download to the SmartGuard controller.

Putting the SmartGuard 600 into Run Mode

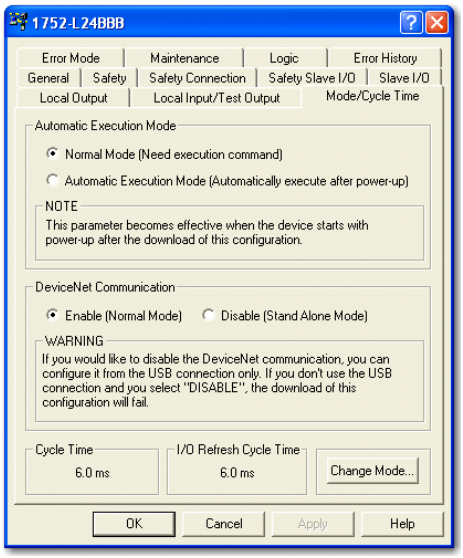
Read this to see how to place the SmartGuard 600 controller into Run mode.

1. From the main RSNetWorx for DeviceNet online node dialog, double-click the SmartGuard 600 icon to see the 1752-L24BBB dialog.

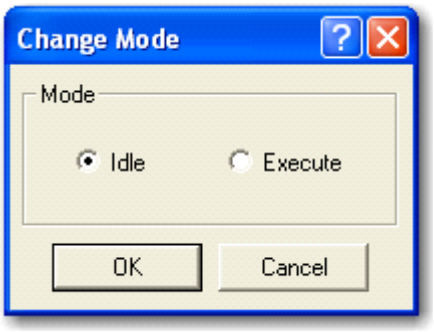


2. From the 1752-L24BBB dialog, click Mode/Cycle Time.

3. From the 1752-L24BBB dialog that appears, click Change Mode.



4. From the Change Mode dialog that appears, click Execute and OK.



The MS and NS LED indicators on both the SmartGuard 600 and Guard I/O module are now solid green. The SmartGuard 600 controller is now in Run mode and is controlling the Guard I/O module.

Specifications

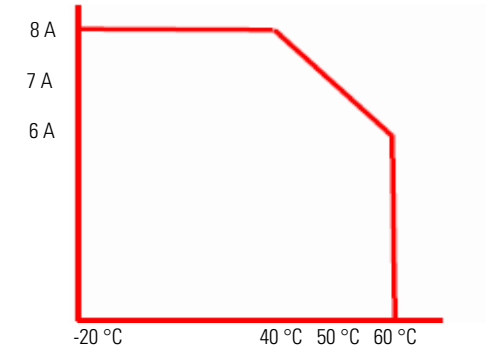
Guard I/O DeviceNet Safety Module 1791DS-IB8XOBV4

Attribute	Value
Safety Input	
Inputs Type	Current sinking
Voltage, On-state Input, Min	11V dc
Current, On-State Input, Min	3.3 mA
Voltage, Off-state Input, Max	5V dc
Current, Off-state, Max	1.3 mA
IEC 61131-2 (Input Type)	Type 3
Pulse Test Output	
Output Type	Current sourcing
Pulse Test Output Current	0.7 A
Residual Voltage, Max	1.2V
Output Leakage Current, Max	0.1 mA
Short Circuit Protection	Yes
Current, Max	25 mA Current, max (to avoid fault when used as a muted lamp output)
Current, Min	5 mA Current, min (at which fault indication is generated when used as a muted lamp output)
Safety Output	
Output Types	Current sourcing/current sinking - bipolar pair
Output Current Rating	2 A max. per point 8 A total module @ 40 °C (104 °F) 6 A total module @ 60 °C (140 °F)
On-state Voltage Drop	+/- 0.6V
Leakage Current	+/- 1.0 mA(1)
Internal Resistance from P to M Terminal	3.25 kΩ
Short Circuit Detection	Yes (short high and low and cross-circuit fault detect)
Short Circuit Protection	Electronic

Attribute	Value
Aggregate Current of Outputs per Module	8 A @ 40 °C 6 A @ 60 °C
Pilot Duty Rating	2.5 A inrush
Number of Outputs	4 dual channel

(1) Includes the presence of a single P stuck-high or M stuck-low short.

General

Attribute	Value
North American Temp Code	T4A
Enclosure Type Rating	Meets IP20
Communication Power Supply Voltage	11…25V dc (supplied from communication power supply)
Communication Current Consumption	85 mA at 24V dc
Operating Voltage Range	19.2…28.8V dc (24V dc, -20…+20%)
Isolation Voltage	50V (continuous), Basic Insulation Tested at 800V dc for 60 s, between Input and Output Channels, and between Network and I/O channels
Product Temperature Versus Current Derating	 Product Temperature Versus Current Derating (combined current from both input and output supplies)
Wiring Category(1)	2 - on signal ports 2 - on power ports 2 -on communication ports
Wire Size	0.34…2.5 mm^2 (24…16 AWG) solid or stranded copper wire rated at 75 °C (167 °F) or greater 1.2 mm (3/64 in.) insulation max
Weight, Approx.	600 g (1.32 lb)
Dimensions (HxWxD), Approx.	81 x 170 x 76 mm (3.1 x 6.7 x 2.9 in.) with terminal block
	66 x 170 x 60 mm (2.6 x 6.7 x 2.4 in.) without terminal block

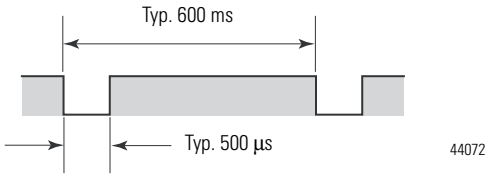
(1) Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Environmental Specifications

Attribute	Value
Temperature, operating	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): -20…60 °C (-4…140 °F)
Temperature, storage	IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock): -40…85 °C (-40…185 °F)
Relative Humidity	IEC 60068-2-30 (Test Db, Unpackaged Nonoperating Damp Heat): 5…95% noncondensing
Vibration	IEC 60068-2-6 (Test Fc, Operating): 5 g at 10…500 Hz
Shock, Operating	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30 g
Shock, Nonoperating	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 50 g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 8 kV contact discharges 15 kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1 kHz sine-wave 80%AM from 80 MHz…2000 MHz 10V/m with 200 Hz 50% Pulse 100%AM at 900 MHz 10V/m with 200 Hz 50% Pulse 100%AM at 1890 MHz 1V/m with 1 kHz sine-wave 80%AM from 2000…2700 MHz
Conducted RF Immunity	IEC 61000-4-6: 10V rms with 1 kHz sine-wave 80%AM from 150 kHz…80 MHz
EFT/B Immunity	IEC 61000-4-4: ±2 kV at 5 kHz on power ports ±2 kV at 5 kHz on signal ports ±2 kV at 5 kHz on communication\ ports
Surge Transient Immunity	IEC 61000-4-5: ±1 kV line-line (DM) and ±2 kV line-earth (CM) on power ports ±1 kV line-line (DM) and ±2 kV line-earth (CM) on signal ports ±2 kV line-earth (CM) on communication ports

Environmental Specifications

Attribute	Value
Reaction Time	
Input Reaction Time, Max	16.2 ms + set values of ON/OFF delays
Output Reaction Time, Max	6.2 ms + (20 ms) relay response time
Signal Sequence	



While safety outputs are in an on state, the signal sequence shown in the figure is output continuously for fault diagnosis. Confirm response time of device connected to safety outputs so the device does not malfunction due to off pulse.

Certifications

Certification	Value	
Certifications (when product is marked)[1]	c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
	CE	European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)
	C-Tick	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions
	ODVA	ODVA conformance tested to DeviceNet specifications
	TUV	TÜV Certified for Functional Safety up to and including Category 4 and SIL 3[2]
	UL	UL Certified for Functional Safety up to and including Category 4 and SIL 3[2]

(1) See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

(2) When used with specified firmware revisions.

Guard I/O DeviceNet Safety Module 1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4

I/O Connectors

Attribute	Value
Wire type	Copper Use the following to wire 1791DS. • 0.2…2.5 mm^2 (AWG 24…12) Solid wire • 0.34…1.5 mm^2 (AWG 22…16) Standard (flexible) wire with insulation-covered bar terminal

Environmental Specifications

Attribute	Value
Communications power supply voltage	11…25V dc (supplied from communications power supply)
Communications current consumption	110 mA at 24V dc
I/O power supply voltage	20.4…26.4V dc (24V dc, -15…+10%)
Operational temperature	-10…55 °C (14…131 °F)
Storage temperature	-40…70 °C (-40…158 °F)
Relative humidity	10…95% non-condensing (1791DS-IB12,-IB8XOB8) 10…85% non-condensing (1791DS-IB4XOW4)
Vibration	0.35 mm (0.01 in.) at 10…57 Hz 5 g at 57…150 Hz
Operating shock	15 g (1791DS-IB12, 1791-IB8XOB8) 10 g (1791DS-IB4XOW4)
Operating environment	No corrosive gases
Overvoltage category	II (per IEC 61131-2:4.4.2)
Weight	420 g (0.93 lb) - 1791DS-IB12, 1791-IB8XOB8 600 g (1.32 lb) - 1791DS-IB4XOW4
Enclosure Type Rating	None (open-style)
Wiring Category[1]	2 - on signal ports 2 - on power ports 2 -on communications ports

(1) Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Safety Input Specifications

Attribute	Value
Inputs type	Current sinking
ON voltage	11V dc min

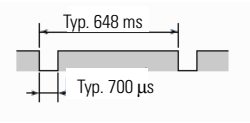
Safety Input Specifications

OFF voltage	5V dc max
OFF current	1 mA max
Input current	6 mA

Test Output Specifications

Attribute	Value
Output type	Current sourcing
Rated output current	0.7 A
Residual voltage	1.2V max
Leakage current	0.1 mA max

Safety Output Specifications

Attribute	Value
Output type	Current sourcing
Rated output current	0.5 A
Residual voltage	1.2V max
Leakage current	0.1 mA max
Signal Sequence(1)	

(1) While safety outputs are in an on state, the signal sequence shown in the figure is output continuously for fault diagnosis. Confirm response time of device connected to safety outputs so the device does not malfunction due to this off pulse.

Safety Output (Relay) Specifications

Attribute	Value
Relay type	G7SA-2A2B EN50205 Class A
Minimum permissible load	5V dc, 1mA
Resistive load	240V ac 2A 30V dc 2A
Inductive load	240V ac 2A (cos Θ= 0.3) 24V dc 1A
Durability (mechanical)	5,000,000 operations min (at approximately 7,200 operations/hr)
Durability (electrical)	100,000 operations min at approximately 1,800 operations/hr)

Reaction Time

Attribute	Value
Max input reaction time	16.2 ms + set values of on/off delays
Max output reaction time	6.2 ms + (20 ms) relay response time, 1791DS-IB4XOW4 only

Certification	Value	
Certifications (when product is marked)[1]	c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada (all models). UL Listed for Class I, Division 2, Group A,B,C,D Hazardous Locations, certified for U.S. and Canada (1791DS-IB12 and 1791DS-IB8XOB8).
	CE	European Union 89/336/EEC EMC Directive, compliant with: EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 73/23/EEC LVD Directive, compliant with" EN 61131-2; Programmable Controllers (Clause 11) (1791DS-IB4XOW4)
	C-Tick	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions
	ODVA	ODVA tested to DeviceNet specifications
	TUV	Functional Safety, Compliant with IEC 61508 (SIL3) and EN 954-1 (Category 4)
	UL	UL Certified for Functional Safety

(1) See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

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